

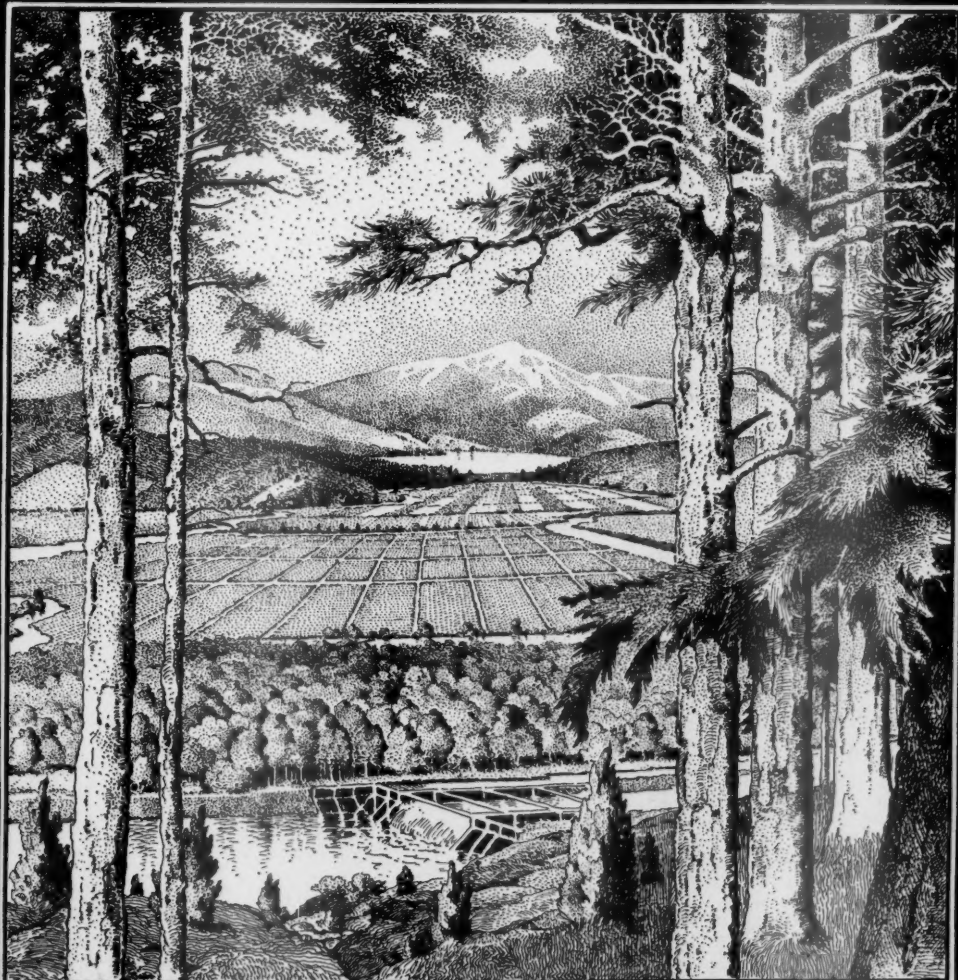
IN THE PHILIPPINE FORESTS. by Gifford Pinchot

Vol. IX—No. 2

FEBRUARY, 1903

\$1.00 a Year; 10 cts. a Copy

FORESTRY & IRRIGATION



Published Monthly at Atlantic Bldg., Washington, D. C.

THE NILE DELTA BARRAGE, by Thomas H. Means

JUDD & DETWEILER
PRINTERS
420-2 ELEVENTH ST.

We Print This Magazine

WASHINGTON, D. C.

'Biltmore Forest School'

at Biltmore, North Carolina

For application and information
 apply to

H. E. HEPNER, Sec'y

JUST PUBLISHED **ECONOMICS OF** **FORESTRY**

By **BERNHARD E. FERNOW**,
 Director of the New York State
 College of Forestry; Late Chief
 Division of Forestry, U. S. Depart-
 ment of Agriculture.

12mo, \$1.50 net. Postage, 15 Cents.

Public Opinion says of it:

"A work that is unique in the English language, and that has not even a counterpart in manner of treatment among the Germans, the first and greatest students of forestry."

The (New York) *Sun* says:

"The subject is treated from a standpoint of practical utility. An entertaining and suggestive book."

The (Philadelphia) *Public Ledger* says:

"The book is to be commended in the highest terms."

The (Detroit) *Free Press* says:

"It presents a great array of facts on this important subject; there is, in fact, no other work in our language which treats it so comprehensively."

Thomas Y. Crowell & Co.
New York

Forestry and **Irrigation** ** **For MARCH**

LUMBERING IN BURMA will form one of the many interesting features of the March issue of **FORESTRY AND IRRIGATION**. The article will be fully illustrated and show the great contrasts between Occidental and Oriental methods.

THE MAPLE SUGAR INDUSTRY will be a timely illustrated description of the time when the sap begins to flow in our northern woods. It will bring up recollections of the "sugar bush" and tell some new things of an important American forest product.

THE SOCIETY OF AMERICAN FORESTERS, a unique organization of professional foresters only, will be fully described, with an intimate knowledge of its interesting personnel.

FORESTRY AND IRRIGATION IN CONGRESS, with other departments devoted to these two subjects, will complete an attractive number.

SCHOOLS & COLLEGES

Maryland, St. James School

ST. JAMES SCHOOL

Individual attention to limited number of boys with testimonials. High moral tone. Athletic facilities.

J. HENRY HARRISON (Princeton), Head Master.

California, Alta, Placer County

AGASSIZ HALL

is a boys' Preparatory School in the Sierra Nevada Mountains. Its boys are encouraged to ride, row, swim, fish, hunt, trap, snowshoe as out-of-school aids toward developing healthy manhood.

HARVARD UNIVERSITY

THE LAWRENCE SCIENTIFIC SCHOOL

offers professional courses in Engineering, Mining and Metallurgy, Architecture, Landscape Architecture, Chemistry, Geology, Biology, Anatomy and Hygiene (preparation for medical schools), Science for Teachers, and a course in General Science. Students are admitted to regular standing by examination and by transfer from other Schools or Colleges. Approved Special Students may be admitted without examinations. New and enlarged equipment in all departments. The Catalogue and special circulars will be sent on application to the Secretary, J. L. Love, 16 University Hall, Cambridge, Mass.

N. S. SHALER, Dean.

... THE ...

University of the South

Sewanee, Tennessee



DEPARTMENTS

ACADEMIC	MEDICAL
THEOLOGICAL	PHARMACEUTICAL
LAW	PREPARATORY



The University of the South is situated in the center of its woodland domain of 10,000 acres, on the summit of the Cumberland Mountains, 2,000 feet above sea level.

Open from March to December, the academic year being divided into three terms. Students from other Universities may attend the summer session, July 3 to September 26, in any department.

The University domain is being lumbered in a scientific manner under the direction of the Bureau of Forestry, U. S. Department of Agriculture, and an unusual opportunity is afforded for the preliminary study of forestry. Sewanee presents an exceptionally attractive field for the study of geology, and forest and field botany.

For further information address

THE VICE-CHANCELLOR

BOOKS ON FORESTRY AND IRRIGATION

Sent Postpaid Upon Receipt of Price

FORESTRY

Flora of the Northern U. S. and Canada, Britton and Brown (3 vols.).....	\$9.00
Our Native Trees, Harriet L. Keeler.....	2.00
North American Forests and Forestry, Ernest Brunken.....	2.00
The Adirondack Spruce, Gifford Pinchot.....	1.00
Forest Trees and Forest Scenery, G. Frederick Schwarz.....	1.50
West-American Cone-bearers, J. G. Lemmon.....	1.00
How to Tell the Trees, J. G. Lemmon.....	.50
Flora of the Southern States, A. W. Chapman.....	4.00
Trees of the Northern United States, E. A. Apgar.....	1.00
Elements of Forestry, F. B. Hough.....	1.50
Our National Parks, John Muir.....	1.75
Trees of New England, Dame & Brooks.....	1.50

Studies of Trees in Winter, Annie Oakes Huntingdon.....	\$2.25
Manual of Botany, Asa Gray.....	2.00
Practical Forestry, Fuller.....	1.50
Forest Planting, Jarchow.....	1.50
The White Pine, Gifford Pinchot.....	1.00
American Woods, Romeyn B. Hough (in nine parts).....	per part... 5.00
Practical Forestry, John Gifford.....	1.20
A First Book of Forestry, Filibert Roth.....	1.25
Among Green Trees, Julia Ellen Rogers.....	3.00
Economics of Forestry, B. E. Fernow.....	1.50

IRRIGATION

Irrigation in the United States, F. H. Newell.....	2.00
Irrigation Engineering, Herbert M. Wilson.....	4.00
Irrigation and Drainage, F. H. King.....	1.50
Irrigation for Farm and Garden, Stewart.....	1.00
Irrigating the Farm, Wilcox.....	2.00
Irrigation Institutions, Elwood Mead.....	1.25

If readers desire books not on the above list let us know what they are, and we will send them at regular retail price, postpaid. Address

Forestry and Irrigation

Atlantic Building

Washington, D. C.

In writing advertisers kindly mention FORESTRY AND IRRIGATION.

HUNTING AND GAME LAW NUMBER OF FIELD & STREAM

America's Illustrated Monthly
Magazine of the Rod, Gun,
Dog, Camera, Canoe, and
Camp * * * * *

The July number was a special ADIRON-
DACK number and the August a MAINE number,
both full of valuable information and notable
issues of a notable magazine. Do not miss them!
Order of your newsdealer or of us. 10c. a copy or
\$1.00 for a year's subscription, including a choice
of six fine pictures worth framing, being hunt-
ing and fishing subjects by famous artists, only
to be had of us.

Mention this publication. Subscriptions may
start with July so as to include above three
special numbers.

Address the Publishers,

The John P. Burkhard Corporation

35 W. 21st Street, NEW YORK.

SUNSET MAGAZINE

It pictures the Wonders
and Special Resources of
the West, and its pages
give advertisers oppor-
tunities offered by no
other publication of sim-
ilar character. Especially
in illustrations is the
magazine noteworthy. *
Upon every page are
artistic halftone engrav-
ings. Subscription \$1.00
a Year; for sale by all
newsdealers. Published
monthly by the Passenger
Department of * * * *

Southern Pacific Company

4 Montgomery St., San Francisco, California

For You to Consider

We want you to know that we have not alone the only publication which is distinctively Western in
tone, but that we have a literary publication the equal of any in the country.

How are we to convince you? By sending you our publication for the year 1903 and letting you con-
vince yourself.

To do this we make a special offer, holding good until **February 1, 1903.**

Before we do this let us tell you what we are offering as our literary menu for the year 1903.

**During 1903 THE NORTHWEST MAGAZINE will give its readers, in twelve
monthly issues, more than—**

20 COMPLETE STORIES, splendidly illustrated, reflecting Western life in Home, Camp, Ranch,
and Field.

50 SHORT STORIES, contributed by the best of fiction-writers—stories of adventure, stories of
achievement, stories of humor—all Western in tone.

200 SPECIAL ARTICLES, contributed by the leading and recognized authorities on Western
subjects.

200 THOUGHTFUL AND TIMELY EDITORIALS on important public and domestic ques-
tions affecting the West.

500 SHORT ARTICLES on the progress, development, and conditions of every section of the
West and Northwest.

500 BRIGHT AND AMUSING ANECDOTES, items of strange and curious knowledge,
poems, and sketches.

ALL OF THE ABOVE SUPERBLY ILLUSTRATED

*Every new subscriber who cuts out and sends this slip or the name of this paper
and \$1.00 will receive The Northwest Magazine for one year. Regular sub-
scription price is \$2.00 per year.*

Address all communications to VICTOR H. SMALLEY, Publisher,

THE NORTHWEST MAGAZINE, St. Paul, Minn.

In writing advertisers kindly mention FORESTRY AND IRRIGATION.

KILNS AND APPARATUS

TO COLLECT

WOOD ALCOHOL

ACETIC ACID ❀❀

WOOD OIL ❀❀❀❀

TURPENTINE ❀❀

FROM THE SMOKE OF WOOD
AND MAKING 45 TO 50 BUSHELS
OF SUPERIOR

CHARCOAL

PER CORD OF WOOD

PLANNED BY

J.A. MATHIEU, Georgetown, S. C.

Everyone Interested

in the mosses, hepatics, and lichens,
one and all, need

The Bryologist

a bimonthly journal freely illustrated with new and artistic drawings and half-tone plates. It gives keys and descriptions of difficult genera; also descriptions and illustrations of new and rare mosses. Articles by leading specialists. Short notes solicited from students. It is indispensable to the working bryologist, professional as well as amateur. Sample copies on request. Address

Mrs. Annie Morrill Smith
78 Orange St....Brooklyn, N. Y.

SUBSCRIPTION, \$1.00 A YEAR

COMPLETE FILES OF

FORESTRY AND IRRIGATION

FOR 1902

A limited number of complete volumes (unbound) of this magazine for the past year may be obtained from the publisher at \$1.50 per volume.

Address

FORESTRY AND IRRIGATION

Atlantic Building

Washington, D. C.

50 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &C.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents. Patents taken through Munn & Co. receive special notice, without charge, in the

Scientific American.

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, \$3 a year; four months, \$1. Sold by all newsmen. **MUNN & Co. 361 Broadway, New York**
Branch Office, 625 F St., Washington, D. C.



In writing advertisers kindly mention FORESTRY AND IRRIGATION

THE

National

Irrigation

Association

NATIONAL HEADQUARTERS, 1707 Fisher Building, CHICAGO, ILL.

Room 6, GLOVER BUILDING, WASHINGTON, D. C.

THOMAS F. WALSH, *President*, WASHINGTON, D. C.

JAMES H. ECKELS, *Treasurer*, CHICAGO, ILLINOIS.

GEORGE H. MAXWELL, *Executive Chairman*, CHICAGO, ILLINOIS.

JOHN H. FOWLER, *Recording Secretary*, CHICAGO, ILLINOIS.

GUY E. MITCHELL, *Corresponding Secretary*, WASHINGTON, D. C.

The objects of the Association, as set forth in its Constitution, are as follows:

1. The adoption by the Federal Government of a permanent policy for the reclamation and settlement of the public domain, under which all the remaining public lands shall be held and administered as a trust for the benefit of the whole people of the United States, and no grants of the title to any of the public lands shall ever hereafter be made to any but actual settlers and homebuilders on the land.
2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in aid of navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.
3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.
4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.
5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.
6. The holding of an annual Irrigation Congress, and the dissemination by public meetings and through the press of information regarding irrigation, and the reclamation and settlement of the arid public domain, and the possibilities of better agriculture through irrigation and intensive farming, and the need for agricultural education and training, and the creation of rural homes as national safeguards, and the encouragement of rural settlement as a remedy for the social and political evils threatened by the congestion of population in large cities.

“Keys to Success”



An Address by Mr. EDWARD
BOK, Editor of Ladies' Home
Journal, in which he analyzes
Success : : : : : : :

SENT FREE



The publishers will send a
copy of this address in booklet
form to any reader of **FORESTRY
AND IRRIGATION** who will ask for

it, enclosing 6 cents in postage stamps to cover mailing
expenses.

“Keys to Success” is one of the many inspiring speeches
contained in **MODERN ELOQUENCE**, a ten-volume
library of the best After-Dinner Speeches, Addresses, and
Lectures of the Nineteenth Century, edited by Ex-
Speaker Thomas B. Reed. The publishers believe
that these complimentary copies of “Keys to Suc-
cess” will prove effective advertising for the sale
of **MODERN ELOQUENCE**; hence this offer.

Cut
off
this
Corner

JOHN D. MORRIS
& Co.,
1201 Chestnut St.,
Philadelphia.

Gentlemen : — Enclosed
find 6 cents in stamps to
cover cost of mailing Bok's
“Keys to Success.”

JOHN D. MORRIS & CO.

PUBLISHERS

PHILADELPHIA

Name.....
Address.....

[BOK 193]

In writing advertisers kindly mention **FORESTRY AND IRRIGATION**.

The Manhattan Life

**Insurance Company
of New York**

3 3 3

ISSUES

ALL MODERN

FORMS OF

POLICIES

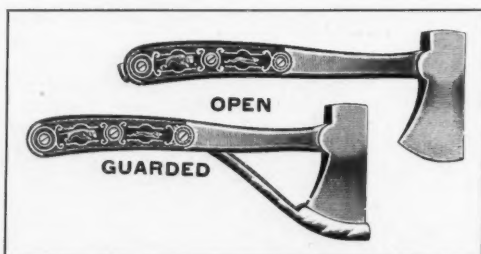
3 3 3

J. T. Hendrick

Manager for Central Eastern Department

715 Fourteenth St. N. W.

Washington, D. C.



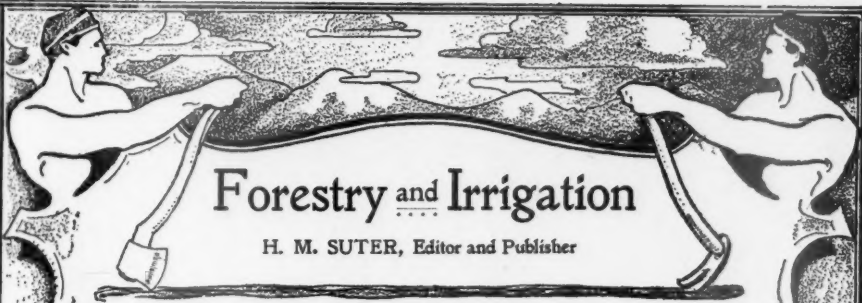
**Marble's
Safety Pocket
Axe**

WILL INTEREST YOU

Send for circular describing it, together with numerous conveniences for campers and hunters.

MARBLE SAFETY AXE CO.

GLADSTONE, MICH., U. S. A.



Forestry and Irrigation

H. M. SUTER, Editor and Publisher

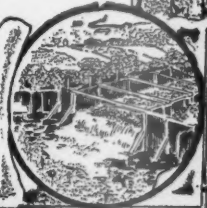
CONTENTS FOR FEBRUARY, 1903

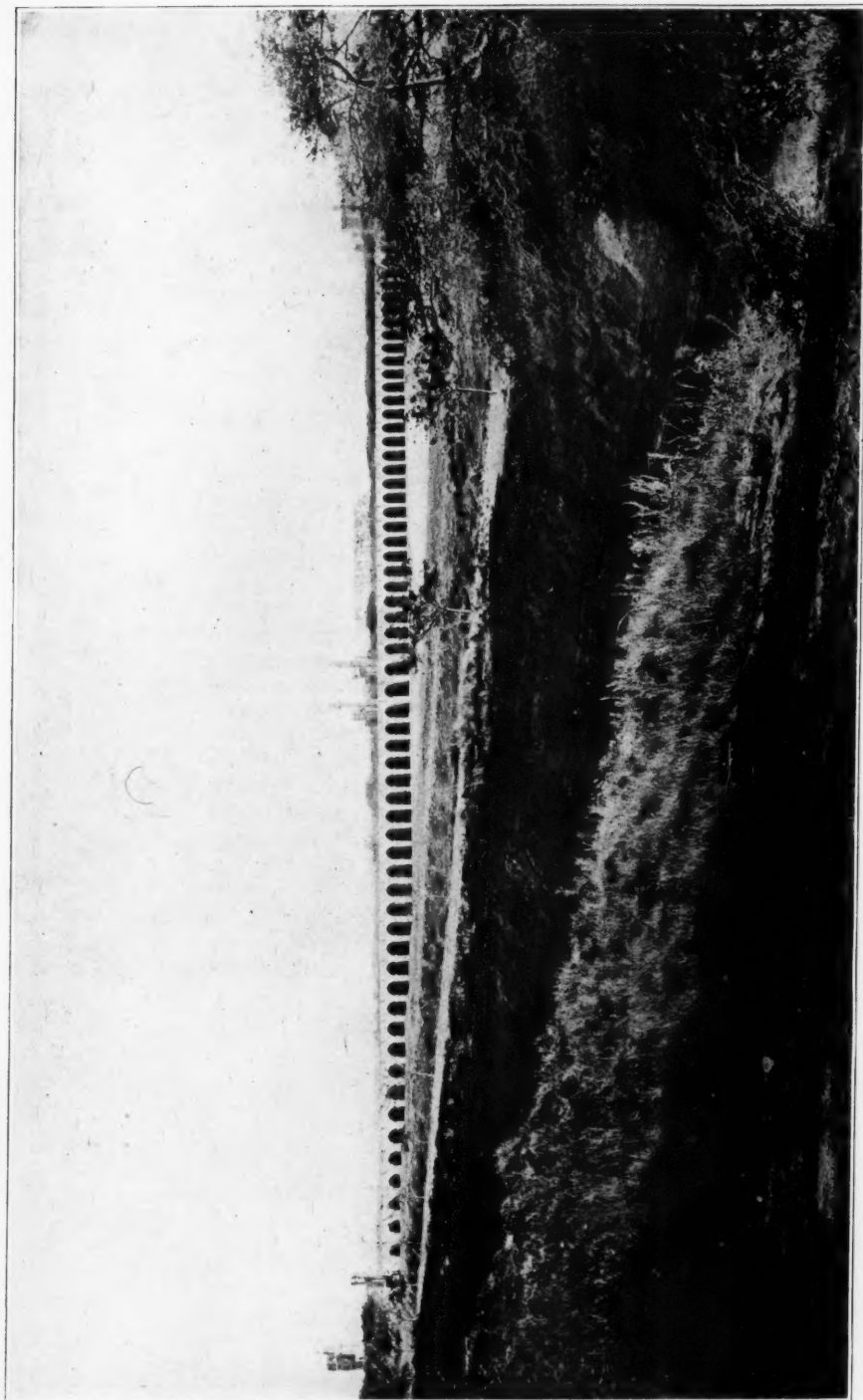
THE NILE DELTA BARRAGE	Frontispiece
NEWS AND NOTES	57
St. Louis Exposition—Forests and Stream-Flow—People and the Forest Reserves—Leaves the Land Office—Biltmore Students' Trip—Forestry in Indiana—Boston's Interest in Irrigation—Children Protest—Forest Reserve News.	
REPORT OF THE FORESTER FOR 1902	62
THOMAS F. WALSH (<i>with portrait</i>)	65
IN THE PHILIPPINE FORESTS (<i>Illustrated</i>)	Gifford Pinchot 66
PROSPECT FOR IRRIGATION ON THE COLORADO RIVER	Frederick Haynes Newell 72
OUTLOOK OF THE TIMBER SUPPLY IN THE UNITED STATES	B. E. Fernow 74
THE DELTA BARRAGE (<i>Illustrated</i>)	Thomas H. Means 79
MINNESOTA'S SYSTEM FOR PREVENTING FOREST FIRES	C. C. Andrews 84
COLONIZATION	Commander Booth-Tucker 86
SILVICULTURAL POSSIBILITIES OF THE PRAIRIES	George Lemon Clothier 89
EXTENT OF IRRIGATION	97
FORESTRY IN OHIO	William H. Lazenby 99
NATIONAL BOARD OF TRADE	100
FORESTRY IN RHODE ISLAND	102
FORESTRY AND IRRIGATION IN CONGRESS	103
RECENT PUBLICATIONS	106

FORESTRY AND IRRIGATION is the official organ of the American Forestry Association and The National Irrigation Association. Subscription price \$1.00 a year; single copies 10 cents. Copyright, 1903, by H. M. Suter. Entered at the Post Office at Washington, D. C., as second-class mail matter.



Published Monthly at
ATLANTIC BUILDING
Washington, D. C.





THE NILE DELTA BARRAGE. VIEW OF THE BARRAGE OF THE ROSETTA BRANCH FROM THE DOWN STREAM SIDE (SEE PAGE 79).

Forestry and Irrigation.

VOL. IX.

FEBRUARY, 1903.

No. 2.

NEWS AND NOTES.

St. Louis Exposition.

The building to be occupied by exhibits of the Forestry and Fish and Game Departments at the St. Louis Exposition will be located on the Tesson tract, immediately west of the grounds and buildings of the French Government. It will have a frontage of 600 feet on an avenue by a width of 300 feet. Because of its commanding position, all of its façades will be highly ornamented. Dr. Tarleton H. Bean, acting chief of the Department of Forestry at the Exposition, states that great interest is being manifested in applying for space for displays in this building. Not only our own people, but many representatives of important foreign countries have already filed applications. Everything at present indicates a full participation in the competition for awards in 1904.

Forests and Stream-Flow.

One of the recent important investigations undertaken by the Bureau of Forestry, U. S. Department of Agriculture, is a study of the relationship of forests to stream-flow in the Rock River watershed of Illinois and southeastern Wisconsin. The investigation was undertaken by the Bureau at the instance of the Hon. R. R. Hitt, Representative in Congress from the ninth district of Illinois.

The study of the forest conditions of the Rock River basin is interesting because it constitutes one of the very few cases in this country in which such an investigation has been made to apply directly to a given stream and locality.

For some years back a marked decrease has been noticed in the flow of

this river, especially during the more critical parts of the summer and autumn. The investigation which the Bureau of Forestry made of this watershed shows that the diminished flow of the river could be traced to several distinct causes. The most important of these are the changes that have taken place in the area and condition of the forests.

The present wooded areas of the Rock River watershed have been considerably reduced in their effectiveness as regulators and distributors of the water supply. This has been brought about by the improper treatment of the forest. The resulting changes in the composition of the woodlands and unwise reduction of the wooded areas are in part accountable for the marked fluctuations in the river flow. The annual water supply has thus been very unevenly distributed, both as to area and periods during succeeding years. The artificial drainage of swamps and other lands throughout a large part of this region has contributed to the same result. It is also shown that there was an actual decrease in the amount of rainfall in the Rock River watershed during the last sixteen years, and this has caused a slight diminution in the actual volume of the river flow, aside from its distribution.

On the other side it may be said, however, that the topographic features and geologic conditions of the Rock River watershed are exceptionally conducive to a sustained water supply, so that the agencies referred to as diminishing the flow did not produce as serious results during the season of drought as might otherwise have occurred.

The result of the investigation is noteworthy for the emphasis it places upon the various effects of forests as protective

covers for the soil, reducing evaporation, and improving the chemical and physical conditions of the soil through the influence of leaf-litter and mold. The regulation and even distribution of the water supply is thereby greatly improved.

The investigation shows, however, that on account of the favorable topographic and geologic conditions of the region, there is but little cause for *serious* apprehension for the industrial and agricultural interests of the region, at least in seasons with a normal rainfall. Nevertheless, attention is called to the great value of a more conservative management of the forested areas in the Rock River watershed. The proper treatment of the wooded areas will be briefly and simply described in a report and will be exceedingly helpful to land-owners in the region.

The People and Forest Reserves.

The following is reprinted from a letter written to the editor by Mr. Clement Hightower, formerly a ranger in the Gila Forest Reserve, but recently put in charge of the newly created Lincoln Forest Reserve in New Mexico:

"Since the creation of the first forest reserves in this country, there has been a strong sentiment of antagonism against the policy; by misguided people, generally those whose personal interests are in some manner affected, but it is frequently encountered in those who should be the staunchest advocates of the policy; that is to say, the farmers and ranchmen in the western states and territories. These people, however, have had unrestricted use of the public domain and the native forests for so long a time that they have come to look upon them as their own, and any interference upon the part of the federal government, by the establishment and administration of forest reserves, as a usurpation of their rights.

"The successful administration of a forest reserve depends largely upon the assistance and cooperation of the people living within and adjacent to it, and to secure this much-desired condition

is in many cases a problem not easily solved.

"The first step in this direction is to educate the people in the vital importance of forest preservation by judicious distribution of the publications of the Department.

"The homestead act should be amended by making it a requirement that the homesteader should plant at least two acres of trees for each forty-acre tract covered by his entry, and that he have at least 100 trees, planted by him, in thriving condition on each acre at the time final proof is made. This could be done without adding any hardship and would be the means of materially enhancing the value of the land.

"In order to encourage the propagation of forest trees within forest reservations and at the same time acquire the cooperation of settlers and land-owners within forest reserves, the free use of timber should only be extended to those who will agree to plant a certain area of their land to trees, the government to furnish the seedling trees. For the purpose of supplying the seedlings, the Department should establish a nursery upon each reserve, where possible. The advantages to all parties concerned would soon be apparent."

Leaves the Filibert Roth, of the Land Office. Bureau of Forestry, who

has for the past fifteen months been chief of the Division of Forest Reserves in the General Land Office, resigned that position on February 6, and again took up his duties in the Bureau. Owing to the great amount of work on hand, the officials of the Bureau of Forestry have found it necessary to call in all the men available.

Mr. Roth was detailed by the Bureau to the General Land Office upon the request of the Secretary of the Interior for assistance in reorganizing the forest work there. In the short time that the work has been under Mr. Roth's direction great improvement has taken place in the administration of the reserves. The patrol system has been thoroughly

reorganized and many other needed reforms instituted. The decided improvement in the work of the Division of Forest Reserves in the short time it has been under the direction of a trained forester emphasizes the advisability of placing the administration of the forest reserves permanently in the hands of the Bureau of Forestry.

Biltmore Students' Trip.

Fifteen students of the Biltmore Forest School will leave for the far south on February 17. The first stop will be at Chicora, at the boundary line between Alabama and Mississippi, where lumbering operations in Longleaf Pine are conducted on a very large scale. Here the students will study lumbering and the reproduction of Longleaf Pine and Cuban Pine and the turpentine industry. They will then proceed to the Bald Cypress swamps of the lower Mississippi Valley, and pay a visit to the Kirby Lumber Company, in Texas, where they hope to see the officials of the Bureau of Forestry at their work on the Kirby tract; thence, traversing northeastern Texas, they will go to Pine Bluff, Ark., with a view of examining the lands owned by the Sawyer & Austin Company, and look into the facts and the scope of the working plan made for the Sawyer & Austin Company by the Bureau of Forestry. Finally, near Memphis, they will visit the hardwood bottoms of the Mississippi, and will return to Biltmore about March 10.

Forestry in Indiana.

The Indiana Board of Forestry was hampered in its work during the past year by the small amount of money at its disposal. Nevertheless, the forest conditions have been carefully studied, and at the same time every effort was made to disseminate information and to stimulate an interest in forestry. Until very recently there has been no official action in the state toward conservative development of its forest resources, and this is the more surprising when the number and importance of the lumber industries of Indiana are taken into consideration.

At the present time the main factor militating against the adoption of forestry is the lack of knowledge of the success of timber growing. The people are conscious of the scarcity of timber and the need for more, and in some cases large manufacturing concerns are buying up extensive areas in other states in order to insure sufficient material for their operations. Most of them are trying to save their timber, and would plant and cultivate extensively if they were assured by practical demonstration that satisfactory results would follow.

The Board does not recommend that the state purchase land and engage in the business of forestry, but it does advise a demonstration by the state that forestry is a practical and paying institution. In that event it is felt that people and capital will be interested in developing forestry on waste lands not valuable for agriculture. Indiana is rich in such lands, the aggregate by recent statistics being 692,738 acres. The timber situation in the state is now as follows: First grade, heavy timber, 250,080 acres; second grade, second growth timber, 834,506 acres; third grade, thin woods pasture timber, 3,733,456 acres. Of the original 18,993,040 acres of dense forest, which was unexcelled by any like area in the United States, there remains about one-seventy-fifth of the former acreage, and not more than one-sixteenth of the original acreage possesses a present timber value. These facts indicate that the state's timber resources are nearing an end. Much of the old timber is in a state of decay and no efforts are being made at reforestation. The legislature is evidently not awake to the importance of forestry, for the annual appropriation made for such work amounts to only \$1,800; \$1,200 of this is the salary of the Secretary of the Board, leaving but \$600 annually for investigations and the dissemination of information.

The Secretary recommends that the state shall in the future purchase certain waste lands at a stipulated small sum, these lands to be developed for forests, and that larger funds be provided for investigating and carrying on

the forest work along lines of propagation, methodic lumbering, forest measurements, forest fires, inspections, etc. As evidence to support these recommendations it calls attention to the fact that railroads and mines use great quantities of timber in Indiana; that the past great supply of good timber has been a potent factor in securing to the state its most important manufacturing industries; and that the timber supply must be maintained in the future if these industries are to be retained and be of the highest value to the state.

Boston's Interest in Irrigation.

The Commercial Club of Boston, one of the oldest and most influential organizations in New England, at its last meeting had for its guest Frederick Haynes Newell, who delivered an illustrated address on the government reclamation service, and explained the workings of the irrigation law of June 17, 1902. The members of the club showed great interest in the subject of irrigation and questioned the speaker freely regarding the policy of the government. This is another example of the way interest in irrigation is spreading among the business men of the East.

Forest Reserve News.

The consolidation of the Teton, Yellowstone, and Absaroka Forest Reserves recommended by the General Land Office is now an accomplished fact through recent Presidential proclamation. This creates the largest reserve now in existence, the total area being about 7,200,000 acres. This entire territory is at present under the management of Special Superintendent A. A. Anderson, of Four Bear, Wyo., assisted by Mr. Robert Miller, of Jackson, Wyo., who is looking after the Teton division, and W. H. Pearce, of Cody, Wyo., who has charge of the Yellowstone division, while the Absaroka service is yet to be organized. The work on these reserves is almost entirely patrol work, the protection of game receiving particular attention. Being a wild section of country, in which

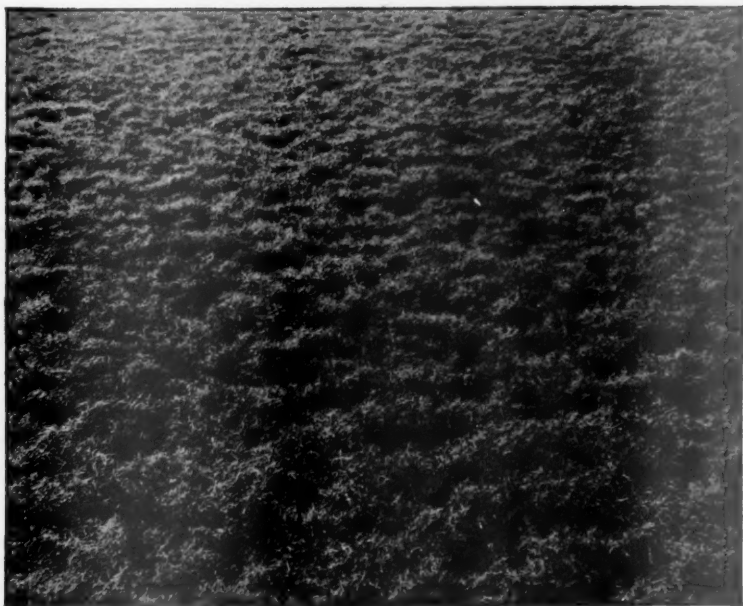
large numbers of elk and deer (also some moose, coming from the National Park) find a winter range, this district has for years been a favorite haunt of poachers, elk-tooth hunters, etc., and the protection at last accorded these animals by a proper enforcement of laws is a timely improvement.

The recent withdrawals in California have provoked considerable discussion of the forest-reserve policy, and there have been many statements of opinion pro and con. The principal value of the discussion is in the rapidity with which it is clearing up the minds of the people and giving the friends of the reserve movement a chance to reveal the excellent points of the forest policy. Unfortunately, however, there is still much ignorance concerning the rights of miners and settlers, and the arrangements for grazing and disposition of timber. This ignorance is being directed in some cases to create a movement in opposition to the reserves. All friends of reserves in localities where there is a division of opinion, and, indeed, all who are interested in the reserve question, from whatever viewpoint, should apply to the General Land Office at Washington for free circulars covering all these disputed points, and should distribute the same where they are most needed.

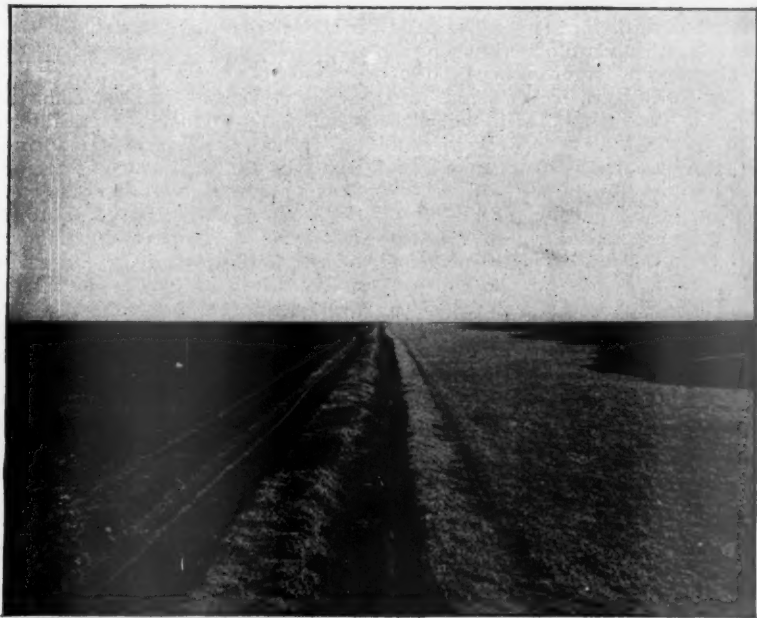
The orders of the Interior Department concerning the disposition of the insect-killed timber in the Black Hills Reserve have led to marked increase in the number of timber sales. Superintendent Bullock feels hopeful of the ultimate repression of the beetle pest in the reserve.

On January 17 the Luquillo Forest Reserve, in the eastern part of the island of Porto Rico, was established.

Matters of interest concerning the personnel of the forest reserves working force are as follows: J. B. Seely, formerly ranger on the Lewis and Clarke Forest Reserve, has been promoted to be supervisor of the newly created Madison Forest Reserve, in Montana. Ranger Chas. Young, of the Lewis and Clarke Reserve, has been placed in charge of the Little Belt Reserve, in Montana. Clement Hightower, formerly ranger in



THE CARPET OF GRASS ON THE PRAIRIES (SEE PAGE 89).



CLEAN SWEEP OF THE PRAIRIE FIRE. ONE EXPLANATION OF WHY THE PRAIRIES ARE TREELESS (SEE PAGE 89).

the Gila Reserve, has been given charge of the newly created Lincoln Forest Reserve, in New Mexico.

The Santa Rita and Santa Catalina reserves, in Arizona, have been placed in the care of Chas. E. Baker, assisted by M. P. Watson, both having served under Supervisor Breen in other Arizona reserves. Thomas Hampton, formerly a ranger in the San Bernardino Reserve, in California, has been given charge of the newly created Mt. Graham Reserve, in Arizona. C. T. McGlone,

one of the rangers of the Gila Reserve, in New Mexico, has been given the supervision of the Chiricahua Reserve, in Arizona. Inspector E. T. Allen is at work in Washington, but reports that unusual snowfall and floods are interfering greatly with his work. Inspector H. D. Langille has finished his work on the Cascade Reserve as far as the winter weather will permit, and is at present occupied in an examination of the lands recently withdrawn in eastern Oregon.

REPORT OF THE FORESTER FOR 1902.

FIRST YEAR'S WORK OF THE BUREAU OF FORESTRY BRIEFLY SUMMARIZED.

DURING its first year as a Bureau, the former Division of Forestry has rapidly assumed the character and functions of its new position. With the increased capacity to do its work, the Bureau has gained in stability and effectiveness, and in the character and value of its results. While from the lack of American foresters it yet falls below a high standard of equipment in trained men, a larger proportion of educated foresters than ever before was engaged in its work, both in the office and in the field. The organization of work made possible by the change from a Division to a Bureau has been of capital value throughout the year.

The progress of public interest in forestry during the year far more than kept pace with the growth of the Bureau. The demands for advice and assistance increase from month to month, and continue to outstrip more and more the ability of the Bureau to meet them. The time for the general introduction of practical forestry in the United States is evidently at hand, provided only the necessary information and assistance can be supplied. The inability of the Bureau of Forestry to meet this demand because of inadequate resources is thus the most serious bar to the protection and perpetuation of our forests. With the rapid extension of professional education in forestry, the need of the Bu-

reau for trained foresters can next year be met more nearly than ever before. In view of the increasingly rapid destruction of our forests, it is most fortunate that the imperative demand for assistance in checking the loss is paralleled by the opportunity to supply the demand, if only the necessary resources in money are made available.

DIVISION OF FOREST MANAGEMENT.

Private lands.—The demands for assistance in introducing practical forestry on private lands increased during the past year almost as much as during the three preceding years. These applications have now reached a total of 4,709,120 acres, under an arrangement by which the owners pay all expenses of the field work except the salaries of members of the Bureau.

The total area of private forests under conservative management, however, reached only the comparatively insignificant total of 372,463 acres, or 7.9 per cent of the total applications. The Bureau has thus been obliged, for lack of men and money, to neglect or defer over 90 per cent of its opportunities to introduce practical forestry on private lands.

It must not be forgotten that the overwhelming bulk of the forests in the United States are in private ownership, and that forest protection by the gov-

ernment, while absolutely of vast importance, is relatively insignificant when compared with the action of the lumbermen and other private owners. In the light of these facts, the inability of the Bureau to respond to more than 8 per cent of the requests for advice in applying the principles which it continually advocates is seen to be the most dangerous of all checks on the progress of forestry.

Field work on seven large forest tracts was completed during the year, and preliminary examinations were made of 1,620,000 acres. The amount paid by the owners for the expense of working plans was \$13,325.

Public lands.—The preparation of working plans for conservative lumbering on the public forest reserves, at the request of the Secretary of the Interior, has continued throughout the year. The total area of these reserves September 1, 1902, was 58,850,925 acres. Field work was carried on during the past year in five reserves. In addition to field work and the computation of results in the office, the force of the Bureau was drawn upon to supply the entire lack of trained foresters in the management of the national forest reserves.

During the year a request was made by the Secretary of War for working plans for eight military wood and timber reservations, with a total area of 117,468 acres. Among these is the military reservation at West Point, upon which field work will be begun without delay.

Field work was completed on townships 5, 6, and 41 of the Adirondack Forest Reserve by the use of an appropriation of \$3,500 made by the New York legislature to cover the field expenses of the Bureau of Forestry.

Forest measurements.—The force employed in computing field results was thoroughly organized. It completed during the year computations of 16,678 acres, and measurements of the rate of growth of 10,786 trees, of 25 species, in 13 states.

DIVISION OF FOREST INVESTIGATION.

Commercial trees.—Measurements and silvicultural facts were gathered for 20 species in various parts of the country.

Studies of hardwood sprout lands were carried on in Massachusetts and other parts of New England, and promise valuable results. A special investigation of the Big Trees of California was begun and is still in progress, and a preliminary study of the swamp forests of eastern Missouri and Arkansas was undertaken.

Studies of North American forests.—The forests of Nebraska were made the subject of an elaborate report, and at the request of the Michigan Forest Commission an investigation of lands in the southern peninsula of Michigan was made, with special reference to the proper management of the Michigan Forest Reserve. Special studies of forest conditions were pushed forward in Kentucky, Ohio, and Texas, and of the distribution of forests in certain portions of New Mexico, Arizona, South Dakota, Wyoming, Montana, and California. In California the study of the relation of forest cover to the flow of streams was continued, and the results will shortly be ready for publication. In coöperation with the U. S. Geological Survey, the study of the Sierra Forest Reserve was completed. In Vermont a coöperative study of the forest resources and conditions of the state was completed, and in Maryland the mapping of the forests by counties, begun in 1899, was continued. Attention was given, both in the office and in the field, to the region of the proposed Appalachian Forest Reserve.

Fires and grazing.—Investigations of the effect of grazing on the forest were conducted in Washington, Oregon, Wyoming, New Mexico, Utah, and California. The study of forest fires was conducted in twelve states, and work was pushed on the preparation of a report.

Dendro-chemical investigations.—Special attention has been given during the year to the chemical investigation of tan extracts from native woods and barks, and of gums from the Philippine Islands. The study of pulp woods, with special reference to the qualifications of untried species, has been carried forward.

Turpentine orcharding.—The investigation conducted by the Bureau into

the methods of producing naval stores in the southeastern United States has resulted in the development of a method which it is believed will radically affect the whole industry. A report is in preparation describing its actual operation.

Forest entomology.—In coöperation with the Division of Entomology, a beginning was made in the investigation of insect damage to the forest, with the direct purpose of devising remedies. The vast importance of the subject makes the continuance of this work imperative.

Various studies.—Investigations of the lumber industry of the State of New York and the maple sugar industry of the United States were completed, and a study of the osier willow industry was begun.

A careful investigation of the Eucalypts and Acacias cultivated in the United States was completed, and bulletins were prepared for each.

Timber construction and supplies.—In coöperation with the Bureau of Plant Industry, great progress was made during the year in arousing the interest of mining and railroad companies in the preservation of timbers and in the sources of timber supply. The practical assistance of many railroads toward the establishment of conservative forestry was begun, and the work shows conspicuous promise.

Forest exhibit.—A forest exhibit was prepared and installed at the Pan-American Exposition, at Buffalo, and later transferred to Charleston, S. C.

TREE PLANTING.

Planting plans.—The coöperation of the Bureau of Forestry with the owners of timber land is paralleled by its coöperation with the owners of treeless areas who wish to plant. Up to June 30, 1902, there were received 262 applications for assistance, in response to 224 of which planting plans were prepared. In the course of the work 197,439 acres of land were examined. The area to be planted under plans already prepared is 6,474 acres. These plans cover 29 states and territories and 172 different localities.

Planted woodlands.—In order to use the information already at hand from previous planting, careful studies of 20 large plantations, 8 in the Middle West and 12 in the East, were carried on during the year. A similar study is now under way to find trees adapted for the southwestern plains.

Forest extension.—Studies of the natural extension of forests were continued during the year. A careful forest survey of a large part of Nebraska was completed, and resulted not only in arousing great interest throughout that state, but in the creation of two forest reserves for tree planting, a most valuable contribution to the forest policy of the United States.

Reserve planting.—Preparations for planting considerable areas in the two reserves in Nebraska were made during the latter part of the fiscal year.

Sand dunes.—Investigations with a view to preventing damage from drifting sand dunes were begun during the year, both on the Atlantic and Pacific coasts, and promise results of great value, especially along the Columbia River.

OFFICE WORK.

The office work of the Bureau has continued to increase steadily in efficiency throughout the year.

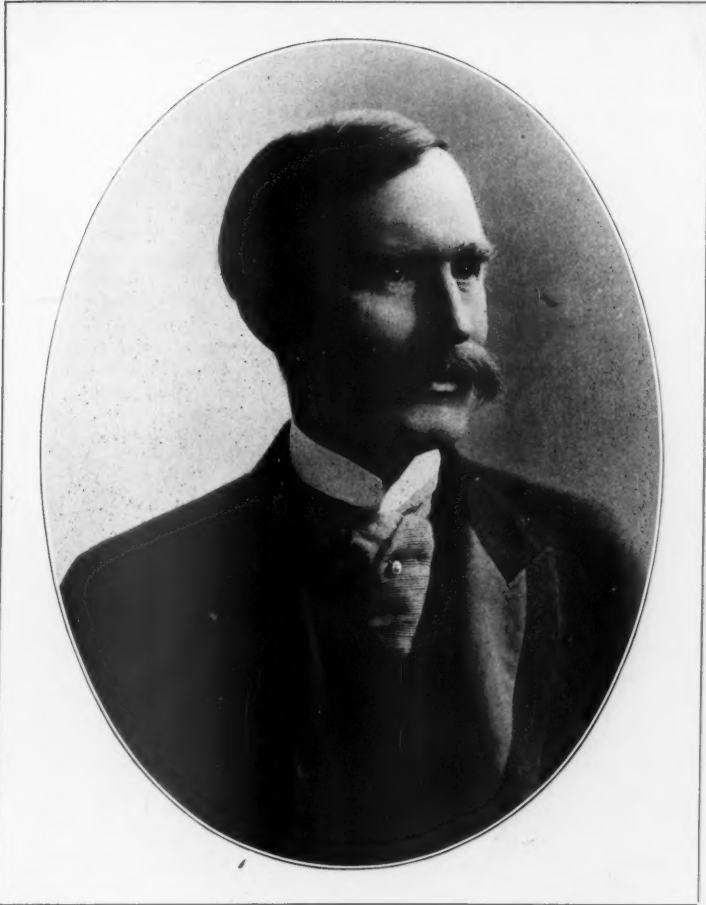
The collection of forest literature from the Department library was transferred to the library of the Bureau, which now contains 1,120 bound volumes, 1,900 pamphlets, and numerous periodical publications.

The photographic collection was largely increased, and is now serving as the source from which nearly all forest illustrations are derived.

The correspondence of the Bureau increased until the number of mail pieces forwarded during the year was 24,538.

Eight new publications and ten reprints were printed during the year, with a total number of 77,200 and 127,500 copies respectively.

A photographic laboratory was prepared at the quarters of the Bureau, and was nearly ready for occupancy at the end of the fiscal year.



THOMAS F. WALSH,

PRESIDENT OF THE NATIONAL IRRIGATION ASSOCIATION.

MR. WALSH, of Colorado, as president of The National Irrigation Association, has done much to stimulate public interest in the development of the West, particularly along the humanitarian side. His strongest contention has been that the government should make possible the building and owning of homes by men who have little or no resources beyond physical strength and a purpose of independent self-support. His influence and assistance have at all times been directed particularly toward this phase of the matter, though he has not overlooked the necessity of work along other lines.

Mr. Walsh went to Colorado about 1870, and, following the customs of the West, became a miner and prospector, trying his fortune in various localities from Canada to Mexico. He has been a keen student and practical observer of all of the facts relating to minerals and their deposition, and has introduced new methods of treating refractory ores. As owner and manager of the Camp Bird mines, he came into prominence as one of the great operators of the country. His wide knowledge of the West has led him to appreciate the great opportunities in other lines than mining, and the dependence of the latter industry to a certain extent upon the development of agriculture.

When it became apparent that the desultory meetings of men concerned in the extension of irrigation could accomplish little through the annual congress, and that it was necessary to form a strong association, Mr. Walsh consented to become president of the body, and as such was a prominent figure in the agitation carried on by The National Irrigation Association leading up to the passage of the reclamation law of June 17, 1902. With this first and great step taken, The National Irrigation Association, under the leadership of Mr. Walsh, is pressing forward to accomplish still further reforms, and is standing ready to guard the interests of the small land-owners, as against the attempts of corporations and large land-owners to turn to their own good the benefits derived from the reclamation law.

IN THE PHILIPPINE FORESTS *

BY

GIFFORD PINCHOT,

FORESTER, U. S. DEPARTMENT OF AGRICULTURE.

OCTOBER 30, 1902.—Up early in the morning, as we were coming into Paluan Bay. We landed about 8.30, on the left bank of the Paluan River, near its mouth, where we found Company L, Thirtieth United States Infantry, quartered in an old church—a smart, neat, and efficient-looking body of men in thoroughly good health and spirits. The commissary was in an old convent at one end of a town of nipa huts. There were a few better houses, but nearly all with nipa thatch and walls.

Scattered through the village were palai pounders, heavy wooden mortars used for hulling rice (palai). Sometimes there were two mortars in a single block of heavy, dark-brown, coarse-grained wood. Usually the mortars were round, about 20 inches to 2 feet off the ground, 18 inches in diameter, and the hole from 8 to 12 inches deep. The pestles were double-ended, about 1 inch thick in the middle and 3 inches at each end, and perhaps 20 to 30 inches long. Under several of the houses were huge brown cylinders, perhaps 3 to 4 feet in diameter and 3 to 4 feet high, for holding palai, apparently made of the inner bark of some tree.

Instead of being supported on bamboo, nearly all these houses were raised off the ground on heavy, round, upright logs. The smaller ones consisted of one room, with a sort of uncovered piazza. The better houses have, in most cases, nipa partitions, in a few cases wooden ones. Where the floors are not of bamboo strips, the usual material, they are of finely polished woods.

On the right bank of the Paluan,

which we reached across a flimsy bridge of bamboo and other poles, were the same nipa huts, none as good as the best of those on the left bank. On the beach were several deep and narrow fishing boats in process of construction. The wood used was Lauan, in long, clear boards.

While this is evidently in part a fishing village, there were no remains of fish or other trash on the shore, and the streets were as neat as possible. Behind the town, in the valley of the Paluan, were extensive rice fields, the crop from which is 20,000 cabanes (90 pounds is one caban) a year. These fields are irrigated by water from the Paluan River, thrown into the fields by a small diversion dam.

We took with us ten Filipinos engaged by Don Mariano, who is interested in forest work because he holds a license now and hopes to get others later on. These men carried light loads. We started about 11.30 and traveled across the rice and grass fields for about two miles to the edge of the forest. The rice fields were of rich clayey, micaceous, alluvial soil, and in the river bottom were loose, flat, round stones of schist, with some quartz. In the flat before reaching the woods were low scattered trees, branching and twisted not unlike apple trees at home and resembling them in leaf. In the edge of the woods the soil was gravelly, but altogether without humus. This absence of humus lasted throughout the day, except on the tops of the flat ridges and on northerly exposures in the dense forests. It was apparently caused in part by the rapid decomposition of the

* Mr. Pinchot, as announced in the January number of *FORESTRY AND IRRIGATION*, recently returned from a trip to the Philippine Islands, taken at the request of Secretary Root. The text of the accompanying article is taken from notes made by Mr. Pinchot during several days spent in exploring the forests of the Island of Mindoro. The illustrations accompanying this article are reproduced here through the courtesy of the Bureau of Forestry.

leaf mold through the action of the sun, and in part by the removal of the dead and fallen wood by termites and other insects. Nowhere was the humus more than one-fourth inch thick, and it was present at all but seldom, although the soil on the slopes and ridges was a clayey loam, well suited to its retention.

The lower part of the forest, after passing the stunted trees at the edge, was composed chiefly of old timber, but usually with an abundance of young seedling growth. I was too unfamiliar

lata) was frequent along the lower edges of the Lauan belt. The Yango, growing to great size, occurred with the Lauan and the Dungon (*Heritiera silvatica*). At somewhat over 1,000 feet a change in the character of the forest gave far greater numbers of low and high saplings and low poles, while the mature trees were smaller in size, of less height, and evidently younger than below. I do not attribute this to the altitude, but to the usual accidental variation in the distribution of species in virgin forest.



MR. PINCHOT'S PARTY UNDER MAMBOG TREE ISLAND OF MINDORO.

with the trees to get a very correct idea of the distribution of the timber, but I remember that two or three trees of Tindalo (*Afzelia rhomboidea*), of moderate size, were found not far from 1,000 feet above the sea, and that Lauan (*Anisoptera thurifera*) was, for considerable stretches, the principal lumber tree, growing tall, cylindrical, and clear-boled to a great height. Above the greater number of Lauan, Boc-boc (*Streblus* sp.) was plentiful, while Taloto (*Sterculia campanu-*

The impression which this tropical forest makes is less unlike the forests of the temperate zone than I had expected. While intolerant trees are manifestly rare, still light has much to do with distribution. The relations of seedlings to seed trees are of the familiar type, and many, both of the younger and older timbers, resemble distinctly, in general appearance, certain species at home.

With the exception of Lauan and a



VIEW OF SHORELINE OF FOREST WEST OF MOUTH OF DIOSO RIVER, ISLAND OF MINDORO.

species of *Diospyros*, the bark of nearly all the trees was colored in shades of yellow, sometimes very light, or of light brown. In addition to the buttresses, their most conspicuous external features were the smoothness of the bark, the almost uniform presence of little knobs, evidently lenticelles, dotting the bark often very thickly, and the remarkable thinness of the latter. I saw no tree except Lauan of which the bark seemed to me over one-half inch in thickness, and usually it was far less. It is common for irregular plates, usually not more than six inches long, to drop from the bark of various species of these trees, leaving slightly sunken scars, which, however, do not differ in color from the adjacent surface. Horizontal, and more especially vertical, rifts, very delicate and small, occur in the outer surface of many trees, and in some there is a marked scaly or fibrous character. The trees are usually tall, seldom cylindrical, except the Lauan, and very generally crooked. They are

better on the slopes than in the bottoms, as I saw them, and far taller, as well as of better form. The mixture of species is an intimate one, although here and there two or three trees of one kind are found close together.

Most of the slopes seen to-day were of south and southwest exposure; consequently less humus was to be expected.

October 31, 1902.—Returning to Paluan, some of us left the main trail and followed the steep valley of a dry torrent down to the Calauagan River. On the way we saw Dungon. In the river bottom were trees of Banaba (*Lagerstroemia Flos-Reginæ*) and an occasional Molave (*Vitex littoralis*). In bark the two species resemble each other considerably, Molave being darker in color, except for the black lenticelles which dot the bark of the Banaba. The latter has a large single leaf, while the Molave leaf is composed of three leaflets and greatly resembles that of the hickory.

November 1, 1902.—We landed at the mouth of the Dioso River, on the north-

west shore of Mindoro, north of Paluan, about half past seven. The shore was lined with Bitog (*Calophyllum spectabile*), Palo Maria (*Calophyllum inophyllum*), Apalaya, and a palm with long narrow leaves, sharply serrated on the edges, light colored, and extremely twisted, and other tropical vegetation. The forest looked more like the tropical forest of my imagination than anything I had yet seen. Near the mouth of the river was an abandoned native hut once occupied by loggers, who had been getting out Calantas (*Cedrela Toona*). I brought back a chip hewed off in squaring a log to show the waste. Near a second camp a hole, apparently to pound palai in, had been cut in a horizontal trunk of a tree. The ground was covered with fruits of various shapes and parts of a beautiful

flower, consisting of a cluster of filaments wide at the base and pink at the extremity, about 5 inches long, and with a delicious odor.

The Dioso River, at present a mere trickle of water, has an extremely precipitous and rather extended watershed. Near the shore it had transported logs of large size and piled them in heaps 3 or 4 feet high along and across the channel. The rock it brought down was but little eroded, having been so short a time in transit, for the whole length of the stream is probably less than 3 miles. The alluvial cone is large and fine, and near the present river course is cut by many channels, each one bordered, as in the case of the one now used, by piles of rocks higher than the surrounding land. On the bank of the river we found a small stump of Calantas cut by



A LAUAN TREE, ISLAND OF MINDORO.



SHORELINE VEGETATION, NORTH SHORE OF MINDORO.

Hareford three months ago. From two branches, which already existed at that time, it had sent out sprouts perhaps 18 inches long, but there was no evidence of sprouting from the stump itself. Because of the difficulty of finding rings, this was the only tree Hareford had been able to analyze in four months on this island.

As we left the river, going east we found immediately considerable quantities of Molave, of good size. Hareford showed me what he thought might be a Molave seedling in the crotch of the first tree of that kind. Examination showed many similar seedlings on the ground, but did not confirm the opinion that they were of Molave, which seemed unlikely from Hareford's statement that the Manyans had been unable to show him Molave seedlings, although he had looked carefully for them.

With the Molave was associated the Dita tree, (*Alstonia scholaris*), which has a thin bark from which exudes a white sap with a taste al-

most exactly like quinine, for which it is said to be an excellent substitute. The tree is of fine size and shape, with smooth, yellowish brown bark dotted with frequent lenticelles. The timber, however, is said to be of but moderate value. We found also Boc-boc and numbers of large specimens of the Yango tree, with gray brown fibrous bark, easily rubbed off with the hand. This tree is said to furnish a poor construction timber, probably of about the value of the third group. It has not yet been assigned to any group.

The Tindalo appeared on the upper slopes in considerable numbers and of fine size and shape. So did the Amuguis (*Odina speciosa*), which I had not seen before. It has moderately dark brown bark and large buttresses, and the reproduction is fairly good. I should judge the tree was most plentiful above 100 feet. There were some specimens of other timbers of fine size, but of kinds which Hareford did not know. This is part of the forest which Hare-

ford and Clark found to contain, between the Dioso and Calansan rivers, an average of 4,000 cubic feet to the acre.

As at Paluan, the increase of size and height of the timber on the slopes was very striking. There were more vines and creepers here than at Paluan, more humus, and a generally richer and more tropical appearance of the forest. Young growth was exceedingly plentiful, especially of the seedling and sapling sizes, but poles and young standards of the valuable trees were scarce. There was more humus than at Paluan, and at places far more trash on the ground. On the upper slope especially there was much fallen dead wood of very small sizes.

We saw few butterflies to-day, or other insects, except ants, which were

everywhere. There were few birds in the forest, but we heard iguanas calling from the trees repeatedly, and once or twice a noise which was probably from a monkey. The call of the iguana is like a repetition of the word "Gecko" or "Tuckoo," with the two syllables well apart.

Along the beach, although we traveled it for perhaps half a mile, I saw no single scrap of fish, although Seymour found some cuttle bone of very large size. There were few shells, most of them of small size, and occupied by hermit crabs, which were even common at some distance in the forest. Little land crabs seemed to be everywhere, even several hundred yards back from the shore.

We got back to the ship about four, and started east along the Mindoro



SHORELINE OF FOREST WEST OF MOUTH OF DIOSO RIVER, MINDORO.

coast. From Mt. Calavita to Puerto Galera, steep hills come close to the shore. There are some cliffs immediately above the water, but of small height. In spite of the steepness of the country, I could see nothing to prevent successful logging, although it is true that I had only a distant view; but it is equally true that the timber in the country I traveled over was perfectly accessible. Near Abra de Olog there is a good deal of clearing on the hills, presumably for the camote (sweet potato) fields

of the natives. At Puerto Galera is a good harbor.

Although we did not go over a half a mile back from the northern seacoast or more than 100 feet above tide, Hareford said that we had seen the characteristic forest. Trees of valuable species were far more common in it than at Paluan, and the whole impression of the country was decidedly richer. Some of the forest looked at times somewhat like a dense young pole wood in the Appalachians, with occasional old trees.

PROSPECT FOR IRRIGATION ALONG THE COLORADO RIVER.

A PROJECT REQUIRING VAST EXPENDITURE WHICH WOULD BRING EQUALLY GREAT RETURNS IN LAND RECLAIMED.

BY

FREDERICK HAYNES NEWELL,

CHIEF ENGINEER, RECLAMATION SURVEY.

THE following notes are from observations made during a four weeks' trip in California and Arizona, in the course of which I floated 400 miles down the Colorado River in a small rowboat. The purpose of this trip was to investigate the possibilities of that section of the southwestern desert country in the line of irrigation, and to get a preliminary idea of the feasibility of conserving the great floods of water which at certain seasons of the year pass down the Colorado River to the Gulf of California.

In some respects this projected enterprise resembles the great reclamation works which have been constructed by the English Government in Egypt, whereby the flood waters of the Nile are impounded and distributed over millions of acres of fertile delta land. To carry out to its full possibilities this great project on the Colorado River would require an expenditure of from \$15,000,000 to \$20,000,000, which would give in return an irrigated area of over 1,000,000 acres of extremely fertile land.

I first went to the Needles, in California, and there secured a wagon outfit and drove up the Colorado River as far as possible, to what is known as Bulls Head, one of the highest sites for a proposed reservoir on the river; then came back through the agricultural lands near Camp Mohave, where the Indian school is situated and where large areas can be brought under irrigation by a high-line canal from the Colorado River. Then I went back to the Needles, and, in company with J. B. Lippincott, consulting engineer; Arthur P. Davis, principal engineer; E. T. Perkins, district engineer, and E. C. Barnard, topographer, started on a trip down the river.

We were five days in an open boat, camping along the banks of the stream at night. We then struck a little river steamer, the *St. Vallier*, which was on the point of starting from Ehrenberg to Yuma. All navigation on the river is suspended at dark, and in fact is also often suspended in the daytime while the crew is engaged in getting the boat off the sand bars. There is a decided current, which runs about three miles an

hour and carries the boat from one side to the other of the channel, the water spreading out in many places over a very wide area. It is easy traveling along these channels until one reaches a place where the river widens out; then the water becomes so shallow that the boats frequently get stuck. The little stern-wheel steamers which occasionally use this river, when they get stuck on a sand bar turn around, and the revolution of the wheel digs out the sand so that the boat can drift on down.

We went down the river about 400 miles in all. The country back from the river is arid and desolate, and has very scanty vegetation except for an occasional thorn bush. It is generally considered to be a highly mineralized country, and there are an almost infinite number of prospect holes and a few mines, but very little, if any, ore is now being shipped. This is probably largely due to the difficulties of transportation.

We saw very few people along the river. An occasional Indian was met, poling his boat against the stream, carrying goods to the mining camps or to the Indian school. These are the Mohave Indians. They all use punts or flat-bottom boats. There seemed to be no white settlers along the river except a few prospectors. We found no mosquitoes at this time of year, and the nights were frosty. The country is semi-tropical, having very hot days and cold nights, especially on the lower levels.

The Colorado River is the largest river of the arid region. It can be compared in size to the Nile of Egypt and is similar in many characteristics. It differs in the flow, for this is not as regular or as well sustained, because of the fact that there are no lakes at the head of the river to insure permanency of such flow. It is navigable with difficulty, however, for light boats on the lower part of the river. A large part of its course is through canyons, where the water cannot be diverted upon the surrounding land. The lower river passes through an open country, varied by a few narrow valleys. The fall of rain there is very slight, and canals taken out fill quickly with silt. Silt is

the great obstacle to the development of the irrigation feature, and ditches will have to be given a heavy grade.

Reservoirs are necessary to store and control the silt. Small works are impossible and large ones will be very costly. The land to be reclaimed is probably as good as any in the United States. The problem of getting water upon it is not easy of solution, for there are many alternative plans. The land will produce large crops in frequent succession, one following the other as fast as it can be planted, grown, and harvested.

For the first 100 miles below the Needles the river is mostly in canyons or narrow valleys and ranges from 200 to 800 feet in width. It is generally very shallow. The valleys upon it grow wider as you go down, and there are bordering bench lands covered with gravel, but having a fairly good soil and one that will be excellent when treated with the muddy waters of the river.

To place water upon these bench lands will require numerous dams from 50 to 100 feet in height and from 800 to 1,000 feet in length. As Yuma is approached the valleys widen out into the deserts of Arizona and southern California, but along this part of the river there are possibly millions of acres which may in time be brought under irrigation. Above and in the vicinity of Yuma dams have been made to divert the water by small ditches, but owing to the large amount of sediment carried by the water these ditches have been quickly filled and rendered useless.

One of the chief difficulties in utilizing the Colorado River is on account of the great amount of fine earth carried in suspension by the water. When the course of the water is checked this material is dropped, filling the reservoirs and canals. It is necessary, therefore, to give the canals a slope so great that the water will run rapidly out at all times and not stagnate at any point until it is put upon the fields. There the fine earth serves to enrich the ground and perpetuates the fertility of the soil.

Below Yuma, on the west side, water is taken out in a large ditch on the Mexican side of the international boundary and carried into natural channels, which

terminate in what is known as the Alamo or Salton River. The Salton River flows into the Salton Sink, which lies partly in the United States and partly in Mexico. Water is now running from the Colorado River into the Salton Sink, but it is necessary to keep at work constantly with dredges on this to keep open the channel from the river to the Alamo. An appropriation of 10,000 cubic feet per second of water has been made from the Colorado River, or about twice the amount of the low-water flow. Only a small part of this water is now actually used, but if the lands are completely developed it will be necessary to provide water storage on the headwaters of the Upper Colorado to furnish the necessary water for the development of the lands in the United States.

The government is now giving some consideration to this project, but of course our observations are merely for the purpose of coming to a thorough understanding of the possibilities of all the arid region of the United States in the irrigation field. This Colorado River project is one of vast expenditure, with equally vast returns in the land which would be available for settlement; with a number of others of similar character it will serve as a sort of reserve outlet for increasing population in the years to come. My trip as a whole was most interesting and valuable, and in course of time we will be able to give some definite idea as to what the expenditure in the building of reservoirs and other works of water conservation would accomplish in that section.

OUTLOOK OF THE TIMBER SUPPLY IN THE UNITED STATES.*

BY

DR. B. E. FERNOW,

DIRECTOR NEW YORK STATE COLLEGE OF FORESTRY.

AS Cotta pointed out a hundred years ago, forestry is a child of necessity. It is only when the wood supplies grown by unaided Nature are exhausted or near exhaustion, and when it becomes apparent that reproduction is not replacing the harvested virgin crop as rapidly as required, that forestry—systematic utilization and reproduction of wood supplies—becomes necessary.

While much has been said and written regarding the influence of forest cover on climate and waterflow as calling for the application of forestry, it should be understood that these considerations apply mainly to specified localities, that some of the claimed beneficial influences are often questionable or at least unproven, and that, moreover, the forest effects may be secured incident-

ally. The supply question remains uppermost and is the more important.

It behooves, then, every forester to find justification for his art and for his own existence in the answer to the inquiry which will bring out the fact that natural supplies are waning and are not being replaced as fast as consumed.

Such inquiry involves knowledge, on one hand, of the consumption of wood products in the given country, the possibility and probability of substituting other materials, and the opportunity of supplying it wholly or in part by importations; and, on the other hand, knowledge of the amount of standing timber ready for use, the condition of the forest areas, as far as promise of reproduction is concerned, and the rapidity with which such new growth may become available.

* Read before Section I, American Association for Advancement of Science, Washington, D. C., December, 1902.

Ten years ago the Chief Geographer of the United States Geological Survey came out in print refuting the writer's contention that a more conservative and rational forest policy in the United States was needed; because, he asserted, the relations of forest growth to climate, soil, and water conditions are presumably of no practical significance, and because, in his opinion, the timber growth in the United States is certainly renewing itself much faster than it is being consumed.

This year, by a peculiar irony of fate, the Chief Geographer, now also in charge of the survey of the federal forest reserves, furnishes, as compiler of the Statistics of the Lumber Industry, in the Twelfth Census, the most satisfactory data upon which to discuss the supply question and to prove wrong his position of ten years ago.

As I have pointed out elsewhere, both the gathering and the interpretation of statistics of forest industries are beset with more difficulties than are encountered in most other industries, largely because of their very diversified character and the very scattered and inaccessible locations of their sources. All census statistics have the tendency to remain below the truth—"some little pigs will not let themselves be counted"—and the statistics of forest products are probably more subject to this defect than others.

The final object of census statistics is, of course, to furnish basis not only for comparison between the various industries, bringing out their relative importance, but also to record the progress of development from decade to decade.

Unfortunately for this last object especially, the absence of a uniform method of enumeration from census to census, added to the variable success of enumerators in securing information, render the data of uneven value. A direct comparison would lead to erroneous conclusions. Proper allowances must be made for defects, variable from census to census, and only very general deductions as to tendencies are admissible.

With this warning against the mathematical use and interpretation of available forest statistics, we propose to pre-

sent the data of the last census, and draw our conclusions as to the *probable* status of the timber-supply question in the United States.

The census of 1900 for the first time seems to have secured tolerably full, although still incomplete, statistics of the lumber industry of the United States, which show that the estimate of the writer, made a few years ago, of 40,000,000,000 feet, b. m., annual consumption, including all material requiring log and bolt size, is as near the truth as it can be possibly stated. The saw-mill product is placed by the census as 35,000,000,000 feet, precisely the amount which the writer deduced from the reported saw-mill capacity in 1898, and the allowance of 5,000,000,000 feet for amounts not enumerated, such as staves, headings, railroad ties, round and hewn timber used locally, telegraph poles, etc., is, indeed, hardly sufficient. Since, however, in the census statistics there are undoubtedly duplications, we may perhaps still adhere, for all purposes of economic discussion, to our round figure of 40,000,000,000 as representing fairly the present annual consumption. The summary of the 1900 census of the saw-mills, planing mills, and timber camps stands as follows, saw-mill product, output of planing mills, custom work, etc., and product of timber camps being mixed together:

Number of establishments (reporting or existing?).....	33,035
Capital invested	\$611,611,524
Salaried officials, 12,530.....	11,260,608
Wage earners, 283,260.....	104,640,591
Miscellaneous expenses.....	17,731,591
Cost of materials used.....	317,923,548
Value of products—total.....	566,832,984
Saw-mill.....	\$422,812,061
Planing mill.....	107,622,519
Timber camps....	36,398,404
Quantity of sawed lumber, 1,000 feet, b. m.....	35,084,166
Value of same.....	\$390,489,873

The figure of \$318,000,000 represents the cost of the logs and all other materials at the various mills which produced the 35,000,000,000 feet of lumber and whatever other products were produced in the mills.

The saw-mills alone seem to have produced from materials valued at \$226,000,-

ooo a product valued at \$423,000,000. In addition to the 35,000,000,000 feet of lumber, valued at \$342,000,000, representing 81 per cent of the whole, the following materials were produced at the mills:

Material.	Quantity.	Value. Million dollars.
Shingles, M.	12,102,007	18.9
Hoops, M.	441,327	2.7
Staves, M.	1,664,792	13.7
Headings, M.	124,089	4.3
Bobbin and spool stock, M feet.	40,037	.5
Furniture stock, M feet.	105,305	1.9
Agricultural implement stock, M feet.	33,250	.6
Carriage and wagon stock, M feet.	82,686	1.8
Pickets and paling, M.	35,804	.3
Laths, M.	2,523,998	4.7
All other sawed products.		19.6

The mill product outside the lumber value was therefore, in round numbers, \$70,000,000.

While these represent reported amounts from regular mills and logging camps connected with them, the independent lumber camps added 3,383,000,000 feet of logs cut for mills, valued at \$20,600,000, and other materials, like logs for export, hewn timber, railway ties, posts, masts, spars, handles, and cooperage stock, etc., aggregating about \$15,000,000.

One very important item which apparently is not included in the above statements, the pulp-wood, forms the subject of a special census, and adds over 2,500,000 cords of log or bolt size material to the above. The consumption of this manufacture alone has more than trebled in the last decade.

In addition to these enumerated amounts, there must be allowance made, not only for what has escaped the enumerator in the regular wood-consuming establishments, but also the very large amount of fuel-wood consumption and other wood cut on farmers' woodlots for home use, which in some other part of the census is valued at about \$110,000,000. According to the Tenth Census (1880), our consumption of fuel wood was at that time 146,000,000

cords, or 2.9 cords *per capita*. Assuming a substantial *per capita* reduction of this item, owing to the increased use of coal, we may still place the present fuel-wood consumption at not less than 180,000,000 cords.

Now, in order to place all these items in a form which makes them comparable to statements of wood production, it becomes necessary to translate them into a unit measure, the cubic foot.

Such reduction brings the consumption of material, for which log and bolt sizes are indispensable, conservatively to about 7,000,000,000 cubic feet (probably nearer 8,000,000,000), and, since most of our fuel wood is cut from similar material, we are perfectly safe in placing our total consumption of "timber wood" (over 3 inches in diameter), for this general discussion, at not less than 25,000,000,000 cubic feet, an average figure which the writer has used before as sufficiently near for an average of the last decade.

The next question is, Are we increasing or decreasing our wood consumption? That, as the population increases, our total consumption increases will appear natural, but that the *per capita* consumption has also constantly increased, in spite of the enormously increased production of coal, iron, steel, and the use of other substitutes, will not so easily be admitted. For such an investigation the defects in the gathering of census statistics above cited become fatal. Nevertheless, if the disproportionate difference between the increase of population and of the consumption is very large, we are safe at least to recognize a tendency.

Taking the census figures as reported for the lumber industry for the last five decades, the increases from decade to decade show the following per cents:

	1860.	1870.	1880.	1890.	1900.
Cost of raw materials.	57	132	41	66	31
Value of lumber product.	60	117	11	88	29
Increase in population.	36	23	30	25	22

Or if we compare conditions at the beginning of the period (1850) and at the end (1900), in the 50 years the popula-

tion grew by 4.6 per cent* per annum in the average, namely, from 23.2 to 76.3 millions; the value of lumber product by 17 per cent, namely, from 60.4 to 566.8 million dollars, and the cost of materials by 20 per cent, namely, from 28 to 317.9 million dollars. Making every allowance for defects in the statistics and for advance in prices, the difference is so large that a great increase in wood consumption *per capita* can be confidently deduced.

If we compare only the figures for the last 20 years, which are more reliable, we find the tenth census recording the value of products at \$233,000,000, with a saw product of 18,000,000,000 feet, as against the last census, reporting \$567,000,000 and 35,000,000,000 feet saw product. In other words, the quantity has doubled, its value nearly trebled, in these 20 years, indicating a change in value of 7 per cent annually in the average (or $4\frac{1}{2}$ per cent compounding) and in increase in material of 5 per cent in the average (or $3\frac{1}{2}$ per cent compounding). The population during this period increased by 2.5 per cent in the average, or, compounding, at 2 per cent; so that it appears that our *per capita* consumption of lumber alone has increased at a compound rate of $1\frac{1}{2}$ per cent, or an average rate per annum of $2\frac{1}{2}$ per cent during the 20 years, not including exports, imports, or much other material not reported.

To assure us that this increase in *per capita* consumption is a feature of modern industrial activity and higher civilization, not confined to the United States, but pertaining to all civilized nations, we may look at the import statistics of other nations, which give quantities as well as values.

Great Britain, which is practically dependent on importations, with large re-

sources of coal, iron, and stone, and hence uses wood, probably, most economically, has increased its imports during the last forty years at the rate of over 5 per cent in the average (or, compounding, at the rate of nearly 3 per cent), while the population increased by less than 1 per cent per annum.

France, which is also relying upon imports to a very large extent, shows a still more striking increase of importations, namely, 10 per cent per annum for the last seventy years, while the population during the whole period increased only 20 per cent. Here progressive deforestation may account for the great increase of imports.

But in Germany we know the cut at home has constantly increased during the last forty years or more, and yet the importations have also increased. While in 1863 her exports of forest products still exceeded her imports by 125,000 tons, after that year a remarkable change has taken place, and today Germany is, next to England, the largest wood importer in the world, with over 4,500,000 tons excess over exports, worth over \$75,000,000, an increase of 10 per cent per annum in the average for the last forty years (or, compounding, at the rate of over 4 per cent), while the population increased only 38 per cent during the whole period. Even the fuel-wood consumption in Germany has not decreased in proportion to the coal consumption, for from 1872 to 1896 the latter increased 103 per cent, while the fuel-wood consumption decreased only 18 per cent.

All of which goes to show that a higher civilization and increased industrial activity make more demands for such a serviceable material as wood. In spite of substitutions, new uses arise to keep up the demand; and we in the United States who, in the sight of plenty, are not wont to save, will probably continue to increase our *per capita* consumption for some time, at least at the rate of Germany.

How are these increasing demands to be supplied? When we have used up our own stores, are there any others to draw on?

Here we must first of all make a

*These estimates are at simple interest on the basis of the figures at the beginning of the period. If a compound-interest calculation is made, the increase in consumption will be found at the rate of somewhat more than 5 per cent in cost of materials, while the population increased at somewhat less than $2\frac{1}{2}$ per cent, making the annual *per capita* increase in consumption nearly 3 per cent, compounding, in which allowance for increase in price is to be made.

sharp distinction between the kinds of wood that are needed for use in the arts.

Some years ago the writer was taken to task by one of the lumber trade journals for asserting that the consumption of coniferous "soft-wood" material represented three-fourths of the total lumber wood consumption, to which the pines contributed to the extent of 50 per cent. The present census brings out precisely this proportion, except that if the pulpwood is added, the importance of the coniferous material is still further accentuated.

The relative importance of the different species is for the first time more fully and very satisfactorily brought out by the census, permitting the following tabulation:

	Quantity—Million feet B. M.	Value—Thousands Dollars.	Stumpage—Aver- age values—Dol- lars per M feet.
CONIFERS.			
White Pine.....	7,483	94,980	3.06
Southern Pine (several species).....	9,580	80,726	1.20
Hemlock.....	1,866	17,832	2.56
Spruce (and Balsam?).....	1,448	16,325	2.26
Cypress.....	496	6,604	1.58
Norway Pine.....	259	3,022	2.88
Cedar.....	115	1,283	1.32
Tamarack.....	9	104	1.00
<i>Eastern Section.....</i>	<i>21,250</i>		
Red (Douglas) Fir.....	1,736	15,050	.77
Hemlock.....	1,560	16,305
Yellow Pine (western).....	1,000	9,235	1.12
Redwood.....	360	3,646	1.00
Cedar.....	118	1,266
Sugar Pine.....	54	659	1.96
Tamarack.....	42	338
<i>Western Section.....</i>	<i>4,870</i>		
All others.....	33	1,114
Total.....	26,153	268,481	
HARDWOODS (broad- leaved).			
Oak (various species).....	4,438	61,174	3.18
Poplar (Tulip).....	1,115	15,646	2.81
Maple.....	633	7,495	2.66
Elm.....	456	5,240	3.30
Cottonwood.....	415	4,304	1.45
Basswood.....	308	3,955	1.50
Gum (Red).....	285	2,748	1.68
Ash.....	269	4,264	3.93
Chestnut.....	207	2,764	2.71
Birch.....	133	1,658
Hickory.....	97	1,815
Black Walnut.....	39	1,412	5.00
Sycamore.....	30	328
All others.....	208	4,015
	8,633		
Totals.....	34,786	116,818	

The White Pine still leads the list, although three or four southern species of pines aggregated exceed it in quantity, though not in value. The relative accessibility to large quantities of supplies predetermines, of course, largely the relative position, especially of the coniferous species, which can be readily substituted by each other. The stumpage prices given in the table, which are based on lumbermen's statements of the values of their holdings, are, in most cases, considerably below the actual prices now paid.

To the statement for spruce, at least 1,000,000,000 feet must be added for wood pulp, and for other species contributing to the same industry, 300,000,000; the cut on farms, which is placed at nearly \$110,000,000 in value, in part log and bolt size material, not brought to the mill, will have to be considered probably, for the most part, in the hardwood cut.

The hardwoods, to be sure, furnish the bulk of the fuel wood, and when it comes to a mere statement of wood volume, represent probably the larger requirement of the total consumption, at least in the United States. Nevertheless, in the arts and industries the softwoods are the most important. These are to be found in quantity only in the north temperate zone, precisely that part of the world where the wood-consuming civilization is most highly developed. The southern countries produce mainly the highly ornamental but exceedingly hard woods, which are only of limited application, hence relatively less important.

The densely populated, highly developed European countries satisfy their requirements in excess of home production from the less developed, thinly populated countries to the north and east—Russia, Norway, Sweden, Austria-Hungary, as well as from Canada and the United States.

The United States must rely upon its own resources and whatever her neighbor, Canada, can spare from its trans-Atlantic trade with the mother country.

THE DELTA BARRAGE.

THE THIRD OF THE THREE GREAT MODERN IRRIGATION WORKS WHICH BEAR SO IMPORTANT A PART IN THE PRESENT PRODUCTIVITY OF THE NILE VALLEY.

BY

THOMAS H. MEANS,

IN CHARGE OF UNITED STATES SOILS SURVEYS, DEPARTMENT OF AGRICULTURE.

EGYPT is a land of contrasts. The ancient plow is seen beside steam plows of the latest model; the temples and tombs of past ages contrast with fine modern buildings, and the crudest of irrigation methods and instruments are offset by works of greater magnitude and importance than can be seen in but few other countries. On the one hand progress, for in many ways Egypt is teaching the world; on the other hand conservatism and practices long discarded by more enlightened nations. In irrigation development Egypt to-day stands a leader in the world. Much has been done in 20 years, and according to the present outlook, at the end of the next 20 years the Nile will be under thorough control, from the tropical lakes of Central Africa to the Mediterranean; the floods will be stored for use in season of low water, loss by evaporation in the swamps of Central Africa will be prevented, diversion dams will control the water at the headgates of the principal canals, and perennial irrigation will be supplied to nearly all lands now under cultivation.

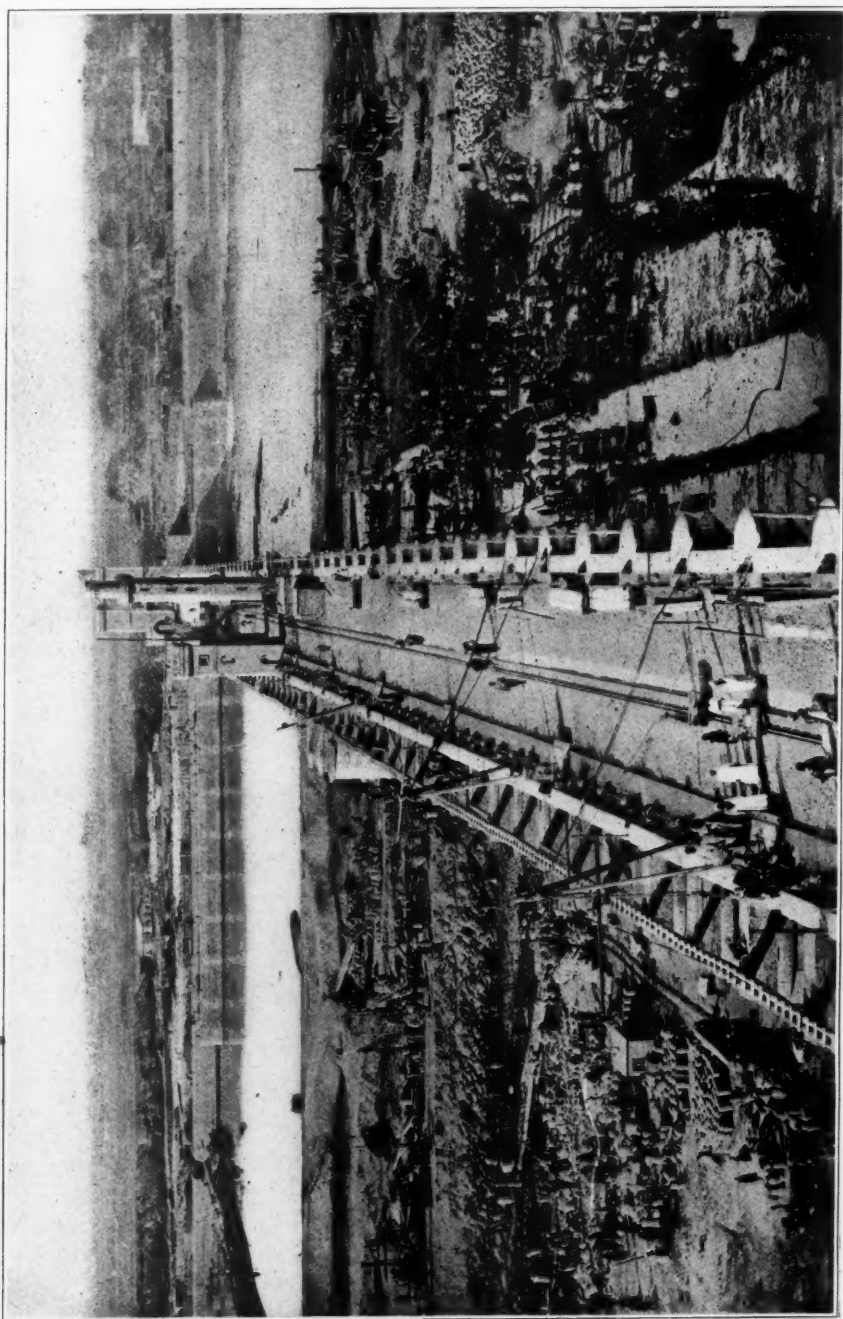
One important link in this chain of river-control works is the Delta barrage, an engineering work commenced in 1833, spasmodically carried to near completion, tested and found inadequate to hold up the waters of the Nile, investigated by commissioners and engineers from many nations, officially condemned by the last French engineer in charge of Public Works in Egypt, and finally officially overhauled, repaired, patched and completed by English engineers. The Delta barrage, after 70 years of history full of discouragement and failures, to-day completely fulfills

the object sought and stands a monument to the persistence and engineering skill of the English officers in charge since 1883. Probably no piece of engineering work in the world has a history more interesting or full of instruction.

The Delta barrage is about 12 miles north of Cairo, at the point where the Nile divides into two branches, the Rosetta branch on the west and the Damietta branch on the east. Train service from Cairo is good, and the barrage, with the beautiful gardens, is a favorite resort for the citizens of Cairo and the thousands of visitors in that city during the winter season. Others reach the barrage by boat down the Nile, a very popular and beautiful excursion in winter.

On leaving the train one finds nearby a narrow-gauge track, which leads to and across the barrage. On this run tram cars, but very different in appearance motive power from those known to Americans. Each car is about 4 feet square and has two narrow seats, back to back. The motive power consists of two men, turbaned and barefoot, who push the car by handles on the side. A good swift trot is kept up, and soon the turrets and the towers of the Damietta barrage are in view.

The barrage, according to early plans, was designed as part of a scheme of fortifications, and was built with a dual purpose. High towers at each end of the dam and two high ones in the center add a picturesque feature to the work. These with the gothic arches of the sluices produce a pleasing effect seldom seen in works of a purely engineering nature.

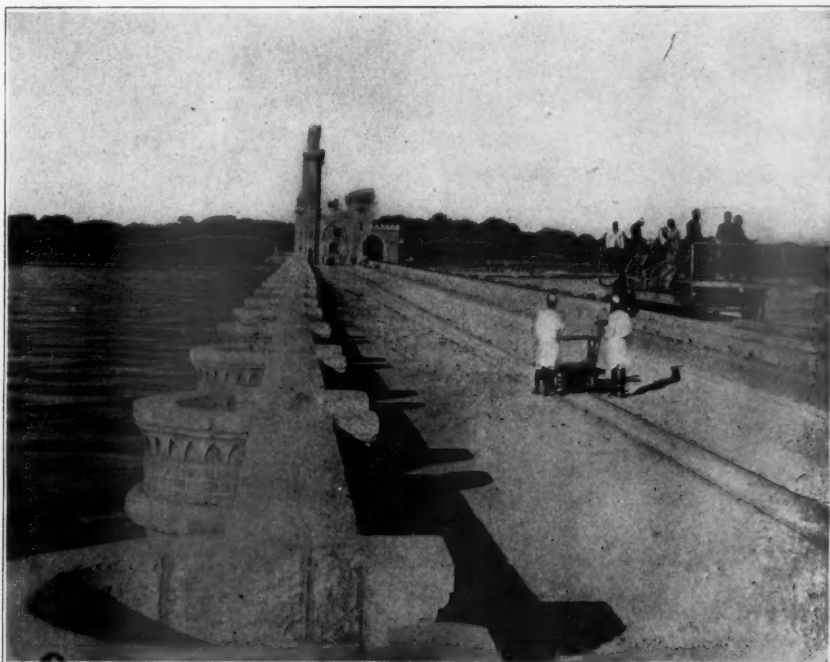


ROSETTA BARRAGE DURING RESTORATION. VIEW TAKEN FROM THE EAST TOWER.

At the beginning of this century all of Egypt was irrigated by the basin method or by lifting the water by pumps. The canals were dry at the season of low water, and only one crop each year was possible, except where water was lifted. In seasons when the Nile flood was not up to the normal, great difficulty was experienced in filling some of the basins. It is recorded that Napoleon during his visit to Egypt conceived the idea of regulating the flow of the branches by damming one branch and thus doubling the flow in the other. In 1820 the first crop of Egyptian cotton was produced, and rapidly from that date cotton increased in importance and value. The introduction of this crop necessitated a change in method of irrigation. The land must be protected from overflow during high Nile and supplied with water throughout the growing season, or for seven months in the year. To accomplish this, deep canals were dug to divert water at low season, but these

canals were so low in the soil that pumping was nearly always necessary to raise the water to the land.

In 1833 Mehemet Ali, the reigning Khedive, actually commenced operations by attempting to dam the western or Rosetta branch. Before this was carried to completion Linant, a French engineer in the service of the Khedive, called attention to the serious consequences likely to follow such a rash step, for all the land west of the Rosetta branch would suffer from lack of water and the supply for the city of Alexandria would be cut off. As a counter-proposition, he suggested the building of a regulating dam across each arm of the Nile, permitting the regulation of the height of the river. With characteristic impetuosity, Mehemet Ali proceeded upon this plan and proposed to use the stone in the great Pyramids of Gizeh to construct the dam. With difficulty his attention was directed toward other supplies of material, and the Pyr-



ROADWAY OVER ROSETTA BARRAGE, SHOWING DISPLACEMENT OF PARAPET WALL DUE TO A SLIP IN THE STRUCTURE.

amids still stand, a source of wonder and admiration to the visitors and of revenue to the hordes of guides and donkey boys.

Work was commenced upon M. Linant's plans, which consisted of two separate dams at some distance below the point of division, in 1833, but the plague cut down the working force, the Khedive lost interest in barrages, and finally, in 1837, work was abandoned. In 1842 another Frenchman, M. Mougel, obtained the confidence of the Khedive and was directed to prepare plans for a new barrage. The point selected by this engineer was at the head of the

sixty-one. These have since been reduced to sixty-one each.

For ten years following the adoption of Mougel's plans work proceeded, but in 1853 Mougel was dismissed and the construction turned over to another engineer. Interest in the work languished until the happy idea of combining extensive fortifications with the barrage was presented to the ruler. Construction was again taken up with vigor, and in 1861 the barrage was practically complete. The barrage was planned to raise the level of the river 14.7 feet at low water. When tested, however, only from 3 to 4.5 feet head could be main-



THE ROSETTA BRANCH WEIR BELOW THE BARRAGE, WITH WORK NEARING COMPLETION.

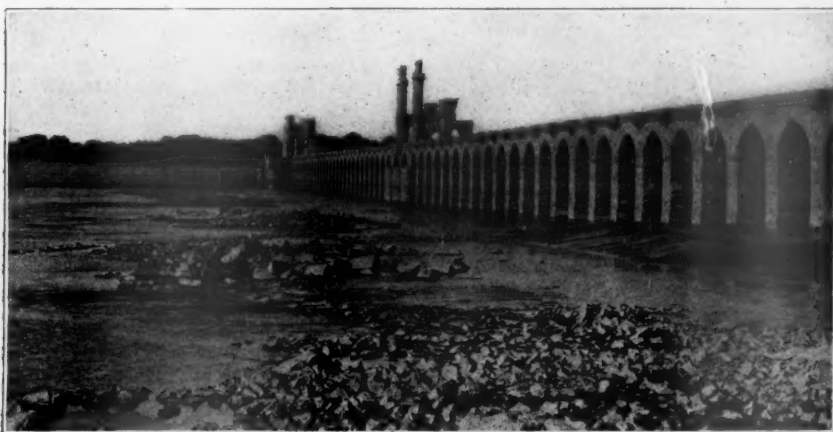
delta, a short distance below the point of division. The barrage was to be in two parts, one across each arm of the Nile, and consisted of a concrete and rubble flooring 11.4 feet thick and 111 feet wide. On this floor were erected piers 30.3 feet high, joined by arches supporting a roadway, making the total structure 45 feet above the flooring. The piers were 6.6 feet thick and 51.2 feet long up and down stream, with openings 16.4 feet wide between. In these openings were to be fitted gates which could be raised and lowered, thereby regulating the flow of water. The Rosetta barrage had seventy-two openings and the Damietta barrage

tained, and then springs developed on the downstream side and in the flooring, and threatened the destruction of the barrage. It afterwards developed that the hasty and careless work, caused by the impetuosity of the Khedive, had resulted in concrete work of very poor character. At one time, impatient at the slowness of work, he directed that 1,000 cubic meters of masonry be laid every day. As soon as pressure was applied the hastily laid concrete gave way, springs broke through, sand from below the flooring was brought up, and dangerous cracks developed in the masonry of the flooring and superstructure. With this discouraging start the barrage

was next examined by great numbers of commissions and experts. Advice of various sorts was given, futile attempts were made to stop the leaks and hold up more water, but without success, and in 1883 the Director General of Public Works officially condemned the barrage, and proposed a system of pumps to raise the water at low Nile. The barrage up to that time had cost over \$10,000,000, not including large amounts of labor enforced upon the natives without pay, and this great work was now considered capable only of regulating the flow in the two branches of the Nile, and in order to do that successfully a

showed the usefulness of the barrage and the advantage of it over pumping plants.

Plans and estimates were then drawn for the strengthening of the barrage, and in 1886 work was commenced by enclosing about one-half of one barrage by an earthen bank and pumping out the water to expose the masonry flooring. In four years the work on both barrages was completed and water held up to a height of 11 feet. Springs on the downstream side proved troublesome, and an attempt was made to bore holes through the piers and force plastic clay below the foundation, in the hope



DOWN STREAM SIDE OF ROSETTA BARRAGE, SHOWING TALUS OR DOWN STREAM APRON.

further expenditure of \$2,000,000 was deemed necessary.

In this same year the first English director of irrigation works came to Egypt. Later Mr. Willcocks came from India and was placed in charge of the barrage. His first work was to carry on some experiments to determine the weak spots in the masonry, and he succeeded in holding up 7.2 feet of water, or 1.4 feet more than had ever been held up by the dam before. In 1885 9.8 feet were held up, but serious cracks appeared and threatened the total destruction of the work. All this time repairs of a more or less temporary nature were carried out, and the success in holding up more water than ever before clearly

that this clay would flow laterally and cut off the leaks. It was found that the clay did not flow as was expected, and liquid cement was decided upon. In all 680 holes were bored through the masonry to the lowest part of the foundation and 6,094 barrels of cement were run below the flooring in the form of a liquid which consolidated, binding together the sands of the river bed on which the barrage rested. After the completion of this grouting 14.2 feet of water were held up without signs of weakness being shown. As an additional precaution, however, to lower the head of water on the barrage proper, it was decided to build subsidiary weirs below each barrage; these weirs consist

of a masonry wall 9.8 feet wide and 28 feet deep, flanked by dry and packed rubble aprons. The downstream apron ends in a cement grouted rubble wall, below which was rock pitching in blocks from a ton and a half to two tons weight. These weirs, shown in the accompanying illustrations, reduce the head of water on the barrage by about ten feet, so that it is possible now without danger to either structure to hold up 30.3 feet of water instead of the 14.7 originally desired. The total cost of the work carried on by the English officers has been something like \$3,000,000, making the entire cost of the work from the beginning, excluding the forced labor, over \$13,000,000.

This barrage now permits perennial irrigation of all the land of Lower Egypt, makes cotton-growing profitable, and

permits the growing of two and sometimes three crops where formerly but one crop could be grown. It has done away with hundreds of pumping plants formerly necessary, and has reduced materially the annual cost of cleaning canals. The actual value to Egypt is difficult to calculate. The cotton crop alone is worth over \$60,000,000 a year, and the value of the other crops raised is proportionally as large. Taking everything into consideration, it seems probable that the barrage pays for itself several times over annually. A very complete account of the barrage has been published by Major R. H. Brown, Inspector of Irrigation, Lower Egypt, and from his book, "The Delta Barrage of Lower Egypt," many of the facts and figures of this article and the accompanying illustrations have been taken.

MINNESOTA'S SYSTEM FOR PREVENTING FOREST FIRES.*

DESCRIPTION OF AN ADEQUATE FIRE LAW
THAT COULD BE ADOPTED TO ADVANTAGE
BY OTHER STATES IN THE LAKE REGION.

BY

GEN. C. C. ANDREWS,

CHIEF FOREST FIRE WARDEN OF MINNESOTA.

THE Minnesota system for preventing forest fires, which is in operation over the greater part of 9,000,000 acres of natural forest country, was enacted in 1895, the year after the Hinckley fire, and its salient features are as follows: It makes town supervisors fire wardens. There are three of these officers annually elected to conduct the public affairs of the town, and they have more influence in the exercise of authority than any one citizen would have separately appointed as fire warden. They travel through their towns on public business, are acquainted with the people, and are in a position to warn any one whom they think liable to be

careless about setting fires in a dry time. They have to post warning notices against fires. They can call upon any able-bodied male citizen 18 years of age and upward to assist in controlling and extinguishing a forest or prairie fire. The chairman of the town board must investigate each fire and report its cause to the Chief Fire Warden. The latter is the central officer to enforce the law, to supply the local officers with instructions and blanks, and to inspire them, if he can, with vigilance. The Chief Fire Warden can mass the fire warden force of the state at any point of danger, and instances have occurred where a force of men has been promptly

* Read at the summer meeting of the American Forestry Association, Lansing, Michigan, August 27-28, 1902.

and effectively moved into another town. Mayors of cities and presidents of village councils are also constituted by law fire wardens.

There is an emergency fund of \$5,000 a year which the Chief Fire Warden can draw on in a dangerous season when fires are occurring or are liable to occur. In seven years only \$5,000 of this has been expended.

It is made the duty of the Chief Fire Warden to investigate the forests in the state, the means used, if any, for regrowth of forests, and to include these and other important facts in regard to forestry in his annual report. The spirit of the law requires him to keep abreast with scientific forestry and to discuss it in a way to cultivate a sentiment for forestry in the state.

The annual appropriation which the legislature makes to carry the law into effect is only \$5,000, which has to pay the salary (\$1,200) of the Chief Fire Warden, for printing his annual report, his office expenses, and one-third of the expenses which counties incur for local service.

As the pine-owners and lumbermen are the principal taxpayers in the forested counties, it was necessary that any new system like this, though it increased taxation ever so little, should have their approval, and it is but just to say that they met the project in a fair manner. They naturally insisted on stringent provisions as to expenditure. Consequently the pay of local fire wardens is limited to \$2.00 per day, but only where actual service is rendered and not exceeding fifteen days in a year. Citizens who help extinguish or control fires are paid \$1.50 per day, but not exceeding five days in a year. The County Commissioners audit all accounts for service, but a county cannot expend an amount exceeding \$500 of public money in a year.

Of course, efficient service cannot be expected without compensation. People will turn out without pay to save their own and neighbors' property, but cannot be expected to work gratuitously several days and nights at fires which do not endanger their individual property. In some of the counties the Com-

missioners have been backward and even delinquent in auditing fire-warden accounts. Uncertainty of pay is the weakness of the system. It would be more effective if the state would pay two-thirds of the expense and the counties one-third. Yet in spite of its faults the system has helped to educate the public to better care of the forests. A new bill prepared by the Michigan Forestry Commission insures certainty of pay for controlling and suppressing forest fires, and I hope it will be enacted.

No one supposes that an extensive forest fire, driven by a terrific gale, can be extinguished by human power. The object of the fire system is to prevent the start of such a fire. The Hinckley fire* of 1894 in Minnesota had been slowly burning a week before the fatal day, and could have been prevented by seasonable precautions. The same is true of the other great forest fires that have occurred in the northwest.

Cities and villages properly incur expense in their fire departments. They exhaust every resource of science and human energy to reach and control a fire at the earliest moment. Is it not just as reasonable for the public to try to prevent and control forest fires?

Certainly there can be no such thing as forestry unless forest fires are prevented. Last autumn, in Morrison county, Minnesota, a forest fire, which spread twelve miles and destroyed \$2,000 worth of hay (of course, uninsured property) belonging to poor settlers, was caused by two small boys who set fire to dry grass to find a lost cow bell. I have known of other fires caused by children too young to be held amenable to law. This has made me think that it might be advisable to introduce some little instruction in regard to forestry and the evil of forest fires into our public schools.

*The Hinckley, Minn., forest fire, the most destructive in recent years, started on September 1, 1894. Hinckley and six other towns were destroyed, about 500 lives were lost, 2,000 persons were left destitute, and \$25,000,000 worth of property was destroyed. This fire had been burning near the town of Hinckley for days and could have been extinguished. Suddenly a high wind came and drove it over the country with uncontrollable fury.—EDITOR.

COLONIZATION.

BY

COMMANDER BOOTH-TUCKER,

OF THE SALVATION ARMY.

IRRIGATION, I venture to claim, is a means to an end, and that end is colonization. Upon the rapid and complete occupation of irrigated lands by a sturdy and aggressive community of small farmers the success of the great project must ultimately depend. Hence, to obviate disappointment, delay, discouragement, and possible abandonment of worthy enterprises, it appears to me of utmost importance that this congress (Tenth National Irrigation Congress) should speak to the nation in no unmistakable terms on this vital question.

To colonize the lands which are to be irrigated promptly and effectively, it is not necessary to wait for the ordinary inflow of farmers possessing capital. We should utilize the vast aggregations of labor in our great centers of population. That this is feasible I believe we may, without boastfulness, claim to have fully demonstrated.

The farm colonies of the Salvation Army were organized in 1898 to prove the possibility of relieving the congestion of our great cities by removing worthy but poor families, furnishing them with the necessary capital, and settling them as home-owners upon the land. Our proposition was epitomized in the following words: "Place the waste labor upon the waste land by means of capital, and thereby convert this trinity of waste into a unity of production," or, as Mr. John E. Milholland, former editor of the *New York Tribune*, has well expressed it, "The landless man for the manless land."

It was argued, however, by those who, while friendly to the scheme, doubted its practicability, that—

- (1) They would not go;
- (2) They would not stay;
- (3) They would not work; and
- (4) They would not pay.

For years the patient experiment has served to prove that these objections were groundless. The worthy poor of our great cities have gone, have stayed, have worked, have paid. As a result of their successful toil, they have become home-owners, and the percentage of failures has been much smaller than even we ourselves had anticipated. Not only so, but thousands more would have gladly settled had the necessary capital been available.

Our difficulties have not consisted in the lack of settlers—suitable families by thousands are ready to move; nor again has it been the lack of land—millions of acres have been obtainable on the most reasonable terms; our one stumbling block has been the paucity of capital available for carrying on the work. It has come in dribbles, and has required to be spread over a considerable area and a long interval of time. Had the funds been available for operating on a larger scale, with a sufficiency of capital, far more satisfactory results would have been obtained.

That colonization is practicable, where the farmer or settler has capital of his own to invest, has never been denied; hence the strenuous efforts of the West and South to obtain settlers who have money from the eastern and central states.

Now, if a farmer with a small amount of capital can accomplish such remarkable results in settling up and developing new lands, why should not the farm laborer, or the sturdy toilers of our cities, who have no capital, achieve similar success if the necessary capital be provided from an outside source. There are many things in his favor: His habits are usually more economical than those of the farmer with a little capital; his children are usually willing to help

in the fields and do not crave an expensive college education. The small size of his farm enables him to cultivate it intensively, while the nearness of the various homesteads enormously increase the value of his land, and thereby automatically duplicate the result of his toil. His payments for interest are also smaller.

This rapid increase in the value of land thus thickly settled serves as ample security for the capital invested, provided that the management be honest, capable, and fairly economical.

The time has now come when scientific colonization must take its place alongside scientific agriculture. The causes of failure must be ascertained and avoided. The principles must be discovered which will insure a maximum of results from a minimum of risk.

The Salvation Army is now operating three colonies in America—one in California, one in Ohio, and one in Colorado. About 400 souls have been settled upon some 3,000 acres of land; the families are entirely self-supporting.

But, interesting and successful as has been our experiment, it is not necessary to rely exclusively upon the data thus furnished. A far larger and more extensive effort has been made by the New Zealand government. In his interesting volume "Newest England," Mr. Demarest Lloyd gives a vivid description of what is probably the most remarkable accomplishment in the realm of modern sociology. While others have been talking or dreaming, the enterprising government of New Zealand has been acting, and laying down lines which will undoubtedly be followed ere long by the leading nations of the world.

The sum of \$15,000,000 has been expended by that country upon the colonization of lands on a system which leaves but little to be desired.

1. The small farmer, who is crushed down by exorbitant interest and being driven to sell out his farm or abandon it and turn to the city, can in New Zealand borrow money from the government at $4\frac{1}{2}$ per cent, and repay it in 34 years, or less if he desires. This checks the exodus from the country to the city.

2. The farm laborer who wants to become a home-owner can buy land from the government, and borrow money at the same low rate of interest and on the same easy terms of repayment. This serves as check number two to the abandonment of the country for the city.

3. The artisan or clerk in the city who wants to buy a farm and own a home can have his savings supplemented in the same generous manner.

4. If he prefers to have a cottage and garden near the city, he can borrow for this purpose and build himself a home near his work, thus supplementing his wages by his garden produce and preparing for the evil day when he may be thrown out of work.

5. If he is stranded in the city and cannot get work, the government, instead of sending him to a semi-penal pauper institution, sends him into the country to make roads and improve some part of the national estate. He is paid wages, part of it in cash for his support and part of it in getting into shape a tract of land which is to become his future home.

Mr. Lloyd testifies to the fact that not a dollar has been lost by the government; that, whereas other nations are sinking millions upon their poor in useless waste and never dreaming of recovering a cent, New Zealand is borrowing at 3 to $3\frac{1}{2}$ per cent, lending at $4\frac{1}{2}$, and settling its lands with tax-payers by means of those who would ordinarily be a burden on its revenues.

This interesting experiment in sociology has been going on for some ten years with complete success; and there seems absolutely no reason why, *mutatis mutandis*, the system should not be adopted in this country and throughout the civilized world. It would not only mean the settlement of our unoccupied lands, but the reoccupation of our abandoned farms by a thrifty, industrious population who would yield a rich revenue to the nation.

The political party which would undertake this much-needed reform would surely intrench itself deeply in the affection of the people to whom it had proved itself so true a benefactor. It would not only be a "full dinner pail" today,

but tomorrow and the day after, also. Such a policy, it seems to me, breathes the very essence of Christianity.

Important as has been the question of colonization in the past, it assumes double significance in view of the immense strides that public sentiment has recently taken upon the question of irrigation. The vast works that are now being planned and will shortly be constructed make it important that prompt and regular returns should be insured for the capital about to be expended by the speedy and systematic occupation of the lands thus opened for cultivation. It is the small farmer who is especially needed for the occasion, and it will be found that wisely guided colonization will prove a most valuable handmaid to irrigation.

Every one who has any experience in the question will be aware that the one discouraging feature in irrigation has been the slowness with which the lands have been occupied on the usual voluntary principle of settlement by farmers with capital. The heavy expenses connected with the upkeep of canals and reservoirs make it imperative that the land should be occupied with the utmost celerity; otherwise the charges for irrigation, falling on the few, become extremely burdensome, if not impossible, alarming prospective settlers and effectually preventing or at least greatly retarding the work of settlement. Moreover, the investors in the enterprise, not receiving any adequate dividends, are discouraged from advancing the additional capital necessary for the development or upkeep of the project.

In arguing with a prominent capitalist, who is president of one of our leading irrigation companies, I pointed out that if it was worth while spending

\$2,000,000 in placing water on the land, it would surely abundantly repay the company to spend at least an equal sum in planting colonists upon it; but, strange to say, the men of intelligence, who had laid out vast sums in perfecting their water supply, were unwilling to "risk" a dollar in supplying capital for the colonization of their land.

The fact, however, that the present Irrigation Congress has included in its deliberations this great question of colonization, and has set its imprimatur upon its possibility—nay necessity—will undoubtedly place the subject in an entirely new light before the country, and will give to colonization an impetus the influence of which will leave its mark upon generations to come. Thus colonization as the handmaid of irrigation will bring within the reach of the latter new confidence and possibilities, and irrigation will prepare for colonization new realms of possibility, while these combined sciences will open before the working classes of this country new vistas of help and hope, will re-create that bulwark of national prosperity, the small farmer, and will provide an immense home market for our productions, making it easier for the masses of our population to be and do good, and to fulfill the obligations of citizenship and the dictates of God and conscience. Thus we may well hope that in solving the problems of poverty the bulwarks of national prosperity may, with the blessing of God, be strengthened and maintained, the dangers of discord be minimized, and the harmonizing influences of religion be extended. In its effort to secure these desirable results this congress may rely upon the sympathy, the prayers, and the hearty co-operation of the Salvation Army.



SILVICULTURAL POSSIBILITIES OF THE PRAIRIES.

BY

GEORGE LEMON CLOTHIER,

BUREAU OF FORESTRY.

THE area of the treeless prairies within the United States comprises in round numbers 900,000 square miles. The treeless region extends far south into Mexico, and many hundreds of miles north of our borders into Canada. The writer is personally familiar with only such of this territory as is included within the boundaries of the United States. Within this region there are 44,000 square miles of forests, including the rudimentary timber belts fringing the water-courses. The estimates of timberland belonging to this region are based on Mr. Gannett's reports to the U. S. Geological Survey. Those who are at all familiar with the region, we believe, will agree that we have credited the territory with all the forest area that exists, if indeed we have not placed the estimates too high. This is a little less than 5 per cent of the total area. The greater portion of this 5 per cent is occupied by mixed hardwoods, of which the majority of the species are of doubtful silvicultural value. In attempting to discuss the forests of the prairies we are often compelled to dwell on the absence of things hoped for rather than the existence of woodlands. The student who would learn the silvicultural possibilities of a treeless region must take cognizance of every woody species, whether of economic value or not. Where grass is the predominant vegetation, shrubs form the skirmish line of the advancing forest. Much of the land of the above listed as "forest" is largely covered with brush or scattering tree growth. This land is potentially forest land if not actually such at present.

Although the figures representing the average annual rainfall of central Texas seem to indicate a moderately abundant

precipitation, yet this region is subject to great extremes of drouth. The vegetation covering three-fourths of the area of Texas is Xerophytic in character. The uplands a few miles southeast of Austin are covered with an open growth of Mesquite and Chaparral. In the ravines of the same locality clumps of Winged Elm trees are occasionally found.

The banks of the Colorado River and tributaries are fringed with a growth of Live Oak (*Quercus virginiana*), Pecan, Red Cedar, Post Oak, and an occasional Bald Cypress. The Pecan is the most stately tree of the valleys. Immediately west of the city of Austin is a region known as the "Breaks," a rough limestone country. Thousands of acres of this rough land are covered with a western Mountain Cedar (*Juniperus sabinoides*). The city of Austin draws its supply of cordwood from these Cedar Breaks.

Arid Texas is crossed by two forest belts known in the local vernacular as the "Upper Cross Timbers" and the "Lower Cross Timbers." The characteristic trees of these belts where investigated are the oaks. The following species were observed near the northern extremity of the Lower Cross Timbers: Post Oak, Black Jack Oak, Spanish Oak, Texas Red Oak, Winged Elm, Red Mulberry, Pecan, Mockernut Hickory, White Ash, Green Ash, Slippery Elm, Red Cedar, and Cottonwood (rare).

The Wichita Mountains of Oklahoma may be considered as a northern extension of the Upper Cross Timbers. The characteristic tree of this region is the Post Oak. The mountain sides are clothed with three species of oaks almost to the exclusion of other species, namely, Post Oak, Spanish Oak, and



POST OAK "OPENINGS" IN THE WICHITA FOREST RESERVE, OKLAHOMA.

Texas Red Oak. The creek valleys at the base of the mountains contain some fine specimens of Mexican Walnut (*Jugans rupestris*) and Pecan, besides occasional specimens of the Red, Chincapin, and Bur Oaks. Other species found in that section are as follows: Three Elms, Ash, Cottonwood, Coffee tree, Persimmon, Mulberry, Redbud, Soapberry, Chittim wood, Hackberry, Mountain Maple, Boxelder, and Red Cedar. The Mesquite grows at the base of the mountains to the south and west and the Black Jack Oak to the north and east. The forest is open and grassy and the trees of the mountain sides are crooked, forked, stunted, and gnarled. The Indians have practiced burning over the mountains for many years in order to increase the growth of the grasses. No species of conifer could endure such a practice unharmed. The Red Cedar persists because it appropriates the stony summits of the mountains where there

is never sufficient vegetable débris to feed a fire. The oaks survive on the mountain sides and in the valleys because of their ability to sprout after being burned.

Near the western boundary of Oklahoma this forest fades out into a scattering growth along the streams, consisting of Cottonwood, Hackberry, White Elm, Western Walnut, Mesquite, Soapberry, Chittim wood, Pecan, Post Oak, Mulberry, Shin Oak, Mountain Cedar, Sumacs, Dogwood, and Wild Currant. The Cross Timbers are open savanna forests, varying from scrub on the high western divides to fairly good local stands of hardwoods on the valleys of the eastern belt. The canyons which cut back into the eastern escarpment of the Staked Plains are said to contain some very fine specimens of Red Cedar. Other trees reported from the locality are Hackberry, Western Walnut, and Soapberry. The Llano Estacado (Staked

Plain) is a tableland about 4,000 feet above the sea-level and is covered with a buffalo grass sod. Under different names it is continued north to the foothills of the Black Hills as a treeless plain, in many parts of the region not even a native Cottonwood being found along the streams for hundreds of miles. This region is the true "Great American Desert" of early writers, but it is believed that with the assistance of man trees may be made to grow in the greater part of this vast territory. In fact, wherever there is a rough or broken area of large extent in this region trees will be found getting a start. Two notable instances are in evidence, namely, the Cedar Breaks of southeastern Colorado and the Pine Ridge region of northwestern Nebraska.

The mountain species of the southwest extend much farther east in Oklahoma and Texas than in Kansas. The flora of central and eastern Oklahoma is almost wholly of eastern origin. The flora of the southeastern corner of Kansas may be taken to represent that of eastern Oklahoma.

In the tier of states extending north from Texas to the Canadian border Kansas possesses the smallest number of western species. Only two Rocky Mountain species have been reported in this region, and they are shrubs. The portion of the state below the altitude of 1,000 feet contains forty-one species not found above this altitude.

There are only 6 species found above 3,000 feet altitude, and they are the following: Hackberry, Green Ash, Cottonwood, White Elm, and two species of willow. Kansas contains but one indigenous conifer, and that is the Red Cedar.

At Manhattan, Kansas, 43 species are found, 31 of which may be classed as trees, the rest being shrubs. The Soapberry is the only western species represented, and it is more than 100 miles out of its range and is represented by a clump of bushes at one isolated spot. The Black Locust was probably

introduced nearly 50 years ago by the early settlers.

Dr. Charles E. Bessey enumerates 66 native species in Nebraska, of which 13 should be classed as shrubs. Nine species of Nebraska trees are of western origin, namely, four species of Cottonwood, Buffalo Berry, Maple, Birch, Western Red Cedar, and Bull Pine.

In the Pine Ridge region of northwestern Nebraska 32 species of woody



YOUNG BLACK WALNUT FOREST IN A VALLEY IN EASTERN KANSAS.

plants were observed by the writer. Only about 9 of these attain sufficient size to be called trees. One stump of the Bull Pine was found that measured 22 inches inside the bark, and the rings counted showed the tree to have been somewhere between 90 and 100 years old. In this locality the pine forest is open and grassy. The reproduction where fires are kept out is enormous, and the young trees have the ability to

take possession of the ground and grow in the densest prairie sod. One sample square rod of ground was measured and the young trees counted, and it was found that there were over 50,000 seedlings per acre on this area, varying in age from 5 to 10 years. The pine in this locality has been cut for lumber ever since the settlement of the country. It grows here associated with species

species owe their existence in this region to springs, which keep the narrow valleys of the canyons moist. These springs are fed from distant sources, probably from the Rocky Mountains. The pine abandons these narrow valleys to the possession of the broad-leaf trees and climbs the most barren pinnacles of the eroded hilltops, where it can get light and room and where a very small proportion of the scanty rainfall ever enters the ground. Its rate of growth in such situations is necessarily slow, but the ability of the species to adapt its rate of growth to the food supply constitutes one of its best qualities.

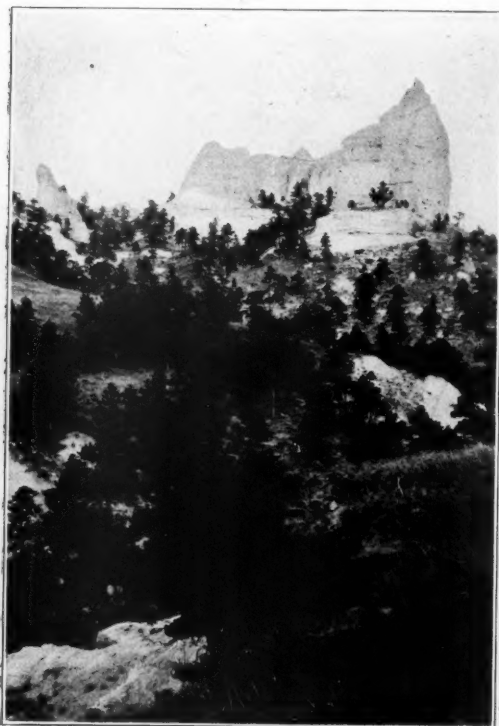
The river valleys of south-eastern South Dakota have a very similar flora to that of eastern Nebraska and western Iowa.

As one ascends the Missouri towards the northwest, the landscape rapidly assumes the aspect of the western arid regions. At Minot, N. Dak., are found some large bodies of stunted timber valuable for a prairie region. The Turtle Mountain district is a natural forest.

The Red River Valley of the North possesses some fine bodies of native timber. Besides the trees, there is an interesting flora of shrubs.

The coteaus of eastern Dakota near the central watershed of the continent have an interesting flora of woody plants. The Hard Maple has found a lodgment in some of the canyons on the eastern margin of the coteaus. Other trees forming the characteristic forest are Bur Oak,

White Elm, Basswood, and Ironwood. The common shrubs are hazel brush, rose bushes, wild plum, and choke cherry. The trees of this district are crooked, gnarled, and low and spreading. The forest is open, and has been burned over by the Indians from time immemorial. This area probably receives a greater rainfall than any other part of either of the Dakotas, and yet the forest is a brush thicket when com-



A YOUNG FOREST OF BULL PINE ENCROACHING UPON THE PRAIRIES IN NEBRASKA.

of eastern origin and shows its superiority in hardiness over every competitor. The hardest eastern species, such as Hackberry, White Elm, Red Cedar, and Green Ash, do not make anything but shrubs on the high table-lands of this locality, and yet the Bull Pine in the same situations grows to be a tree large enough for saw-logs. This is in a territory where the rainfall is less than 17 inches per annum. The broad-leaf

pared with that of the Turtle Mountains.

The great majority of the prairie species have migrated from the forests adjacent to the Great Lakes or from those of the Lower Mississippi Valley. The causes for the migration of some species and the lagging behind of others are questions of vital interest to the silviculturalist. There is no doubt but that the first species to occupy the sand-bars and mud flats along our western rivers were the willows and the Cottonwood (species with light downy seeds easily transported by the wind). These were followed closely by the ash, elms, and maples having winged seeds. With the advent of trees along the river brink came the birds and other small animals, officiating as carriers and assisting in the distribution of the Red Cedar, Hackberry, cherries, plums, Mulberry, and other species having edible fruits containing seeds with hard, indigestible coverings. The hickories, walnuts, and oaks were probably the last to

enter the region, and were no doubt gradually extended by means of squirrels and other small animals. The Tulip tree, the Chestnut, and the Beech lingered behind, and with these all the eastern conifers except the Red Cedar. The most plausible explanation for the absence of the majority of the conifers is the prevalence of prairie fires. The deciduous trees can sprout up from the roots when once burned off, but the pines cannot usually do this. Artificial plantations have demonstrated the fact that the White Pine can be made to flourish as far west as the hickories, and that the Banksian Pine will thrive on the sand-hills of central Nebraska and on the prairies of eastern Dakota. The Norway Spruce and European Larch are successfully grown throughout the prairies of Missouri, Iowa, and southern Minnesota.

The Ozark Mountain region was first supplied with trees from Kentucky and other southern Appalachian districts. When trees were once established in the



NATIVE HARDWOODS IN THE RED RIVER VALLEY OF NORTH DAKOTA.



PIONEER COTTONWOOD TREES IN OKLAHOMA, SHOWING OPEN NATURE OF FORESTS WHEN WHITE MEN FIRST ENTERED THIS REGION.

Ozarks this region served as a base of supplies from which the territory to the north, west, and southwest was stocked. The Minnesota forests had much less influence on the prairies because they were separated from the territory to the west until quite recently by Lake Agassiz, which occupied the valleys of the Minnesota and Red rivers. The advancing hardwood forest of central Minnesota is at present rapidly extending westward.

The forests of the Rocky Mountains have not extended eastward as rapidly as the eastern forests have extended westward. There are several explanations of this fact. The western forests are composed chiefly of conifers, and it has already been noted that conifers are not as able to endure prairie fires as broad-leaf species. Another cause operating throughout the region at the eastern base of the Rocky Mountains is the high aridity of the region and the suddenness of the change from the humid mountains to the arid plains. This barrier seems to be greater than evolution can overcome. The gradual change from humidity to aridity in passing from

the Mississippi towards the west is favorable to evolution, and has allowed eastern species to push their way gradually farther and farther west.

The trend of the Rocky Mountains is across the path of the trees that would migrate eastward. It is probable that the mountain walls have acted as a physical barrier to the passage of the trees, especially the conifers. The high peaks, being too cold and barren to sustain arboreal vegetation, have greatly retarded the eastern progress of all species except such as have light, feathery seeds, easily transported long distances by the wind.

More than 95 per cent of this vast interior region is still treeless. There are a number of causes for this condition. The first is a lack of time for the forests to extend themselves across the vast distances necessary to be traveled. It happens that the species endowed with the greatest facilities for migration are those that demand large supplies of moisture, such as the willows, Boxelder, and Cottonwood. These trees are incapable of spreading to the high prairies, although widely distributed throughout

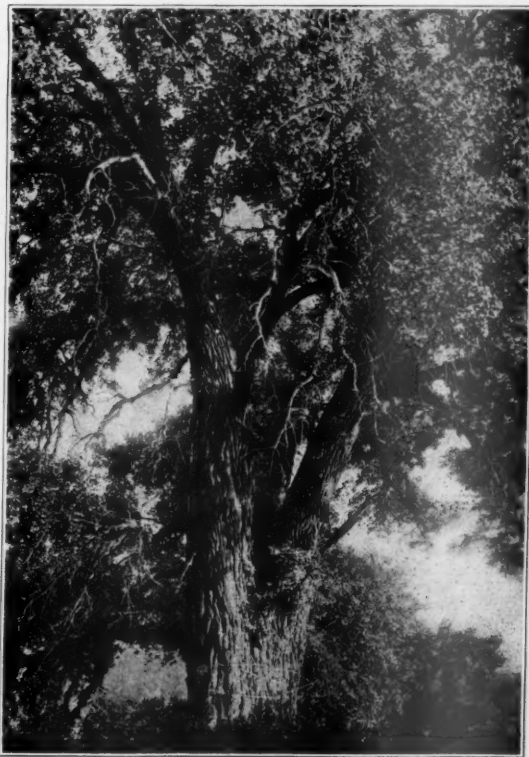
the region, because incapable of reducing their demands for moisture to within moderate limits. They are thirsty trees in a country having an arid atmosphere, and in order to survive they must remain where they can send their roots to inexhaustible subterranean supplies of moisture. This fact confines their distribution to the river banks.

The slow-growing, hardy species like the oaks have been the late comers into the country and have not had sufficient time to get complete possession of it.

The second cause is the predominance of the grasses in the region. The first plants to appropriate the land when it emerged from the sea were sedges, rushes, and grasses adapted to endure alkaline and salty soil. These plants have evolved offspring possessing the ability to endure great extremes of drouth, heat, and cold, and proof against injury from fire. The experience of orchardists and farmer tree planters in the prairies has demonstrated that our eastern species, on good soil, cannot compete singly with the prairie grasses, no difference how great a supply of moisture is furnished, either by rainfall or irrigation. There is only one way in which eastern trees may conquer the prairie grasses and that is by advancing in solid phalanx. This method of encroachment is necessarily very slow and accounts for the lack of time since the glacial epoch for the trees to extend their supremacy over the whole prairie region. A hickory, oak, or walnut tree that could extend its offspring 100 feet from its base in its lifetime of 100 years would be endowed with vigorous reproductive capabilities. This would mean a possible advance of one foot per year. At this rate of encroachment it would take a phalanx of trees 5,280 years to move a

mile, or 2,112,000 years to march from the eastern to the western boundary of Kansas.

Another cause that has operated in the past to prevent the trees from extending into the prairies was the presence of millions of buffaloes in the region. The buffalo grass is most thrifty



VETERAN COTTONWOOD TREE WHICH STOOD ON BANK OF KANSAS RIVER NEAR MANHATTAN, KANSAS. TREE MEASURED 27 FEET IN CIRCUMFERENCE, JUNE, 1900.

where severely grazed, and there is every evidence to prove that the land was taxed to its utmost to maintain the vast herds of wild animals whose presence in the country prevented even the taller grasses from spreading to the uplands, and whose tramping furnished the ideal conditions for the thrift of the short grasses. The presence of the

buffalo attracted the Indians to the region on hunting expeditions. The Indian, either purposely or accidentally, set the dry grass on fire yearly, and these prairie fires raged unhindered over hundreds of thousands of square miles. The fires and the buffalo confined the trees to the river banks or to mountainous and broken land. The buffalo was a clumsy animal and avoided steep slopes and miry, wet soil. Both of these classes of land were appropriated by the trees simply because they were not browsed off by the buffalo and because fires did not burn in such situations with as great intensity as on the flat or slightly undulating plains.

Another reason is the smooth surface of the country. There seems to be a law of nature that plains are better adapted to the growth of grasses than mountains or hills, and that hilly or broken land is more suitable to the growth and propagation of trees than flat land. To understand that such a law exists one needs only to remember that the great plains of Europe, Asia, Africa, Australia and parts of South America are treeless, while all mountain ranges having sufficient soil to support vegetation are forested. The languages of the various tribes of men have from time immemorial associated a flat country with a grassy country. The terms *Prairie*, *Savanna*, *Steppes*, *Llanos*, *Pampas*, and even meadow designate not only grasslands, but flat stretches of grassy country. On the other hand some languages have but one word for both a forest and a mountain.

In traveling over hilly regions within the prairies one sees this law exemplified in a thousand different situations throughout our western states. South-eastern Colorado is hilly, and consequently this section supplies Red Cedar posts for the prairies a hundred miles away, although the rainfall of this cedar-growing district is only about 12 inches per annum. Western Nebraska is hilly and is consequently a potential pine forest, even supporting saw-mills at present. Parts of eastern Kansas are hilly, and on these hills natural forests rapidly spring up whenever prairie fires are kept out for a series of years.

Sometimes the consistency or lack of consistency of the soil has the same effect as though the land were hilly, as, for example, extremely sandy soil. The loose sand is not a good foothold in which the grasses can establish a dense sod; hence trees usually get possession of such soil and crowd the grasses out. The sand-hills along the Cimarron River of central and western Oklahoma are covered with a growth of Jack Oak which stops suddenly at the edge of the sand. The soil of the sand-hills is much poorer soil for the growth of any agricultural crop than that of the hard clay land adjacent, but the former will not hold the grasses, while the latter will, and the competition between trees and grass has resulted in driving the trees to the poorer land.

The condition which causes the grasses to form a less dense sod on a hillside than in a valley is due to gravity. The natural position of grass roots is to spread out in a horizontal plane, and the greater the surface deviates from a horizontal position, the less the tendency will be for the grass roots to spread; hence grasses on a hillside tend to form an open, bunchy sod. The effects of erosion are greater on sloping than on flat land, and erosion also tend to break the sod into isolated bunches. The open spaces between the bunches of sod are excellent places for the germination of tree seeds. When the trees have once gotten a start they drive out the grasses by means of their shade.

The advance guard of the forest usually consists of shrubs such as the Sumac, Wild Plum, Choke Cherry, Hazel Bush, and Buffalo Berry. These shrubs all propagate by underground stems and roots which are stealthily extended out into the sod under the grasses. The off-spring remain connected with their parents and are supplied from parental stores of nourishment until they have accomplished the destruction of the competing grasses. After the shrubs have succeeded in establishing partial forest conditions, seeds from the more pretentious forest species succeed in germinating among the advancing thicket and the tolerant

species finally overtop and kill out their shrubby benefactors.

In this struggle for existence, which is always very severe between woody plants and grasses, the victory is often with the species which first gets possession of the land. The native grasses of the prairies are peculiarly adapted to compete successfully with trees of eastern origin because of the ability of the grasses to endure prairie fires unharmed. The western grasses are also provided with vigorous underground vegetative organs which serve to propagate the species for an indefinite period without the production of seed.

Another cause which operates over large stretches of country in the western portions of the treeless plains is the presence of alkali in the soil. We have seen that our eastern species were probably evolved on the rain-beaten summits of the Appalachians and the Ozarks. The species entering the prairies from the east were not originally adapted to endure a salty soil. The evaporation of the remnants of the cretaceous sea left large deposits of saline matters in the prairie soils, and the scanty rainfall of parts of the region has prevented these deposits from being washed out. The result is that large areas of the great plains possess soils inhospitable to the growth of trees. Wherever the alkali of the soil is excessive we need not hope to be able ever to grow forests.

If we trace out the western limits of

distribution of a number of our eastern species we will find that the following seven extend farthest west in the north central states: Green Ash, Hackberry, White Elm, Red Cedar, Bur Oak, Cottonwood, and Boxelder. The Boxelder and Cottonwood are enabled to exist because they appropriate the river banks where the water supply is abundant. The ash, oak, elm, hackberry, and cedar will all grow on high, dry land. They accomplish this result chiefly by adapting their rate of growth to the food supply or to the water content of the soil. In the south central states the Post Oak and Black Jack replace the Bur Oak. The Hackberry, White Elm, and Red Cedar extend farthest west into the Texas table-lands, meeting and mingling with the Soapberry, Western Walnut, Mountain Cedar, Mesquite, and other southern and western species. It is believed that the species above enumerated include the only native trees of eastern origin that can be made to survive for any considerable length of time on the arid prairies of the West.

The western species, where they have been artificially planted, promise much more satisfactory results than any of the eastern species. This is particularly true of the Bull Pine.

If one considers the eastern part of this prairie region, it will be found that there is quite an array of promising species that deserve artificial propagation and encouragement when growing naturally.

EXTENT OF IRRIGATION.

INTERESTING CENSUS FIGURES ON THE WORK DONE AND THE POSSIBILITIES UNDER THE NATIONAL IRRIGATION ACT.

THE acceptance by Congress of the principle of federal aid in the construction of irrigation works in the western states has given a great impetus to every industry in that section of the country. The people of the eastern states are just beginning to realize the opportunities offered in the territory to be opened up. As the proposition develops, a tide of immigration will

inevitably set in and this region will become one of the most populous and prosperous in the country.

The actual work of surveying, locating, and constructing reservoirs and other irrigation works will be done by the Geological Survey. In order to obtain a better understanding of the present extent of irrigation, the location of the areas irrigated, and to gain

other information useful in this work, the Fifty-seventh Congress authorized the Director of the Census to bring down to date the irrigation statistics obtained in 1900 by that office. Letters of inquiry and schedules are now being sent out to secure the necessary information. All interested in irrigation should answer as fully and as promptly as possible any inquiries they may receive, so that the merits of the various sections of the country may become known. Irrigators who do not receive blanks within a reasonable time should notify the Census Office at Washington and they will be supplied.

It is interesting to note in this connection what it will mean to the country at large to have the arid lands of the West reclaimed.

According to the census of 1900, the total improved farm area of the United States was 414,800,000 acres. It is conservatively estimated that the reclaimable area is not less than 50,000,000 acres. Its reclamation, therefore, will add nearly one-eighth to the actual crop-producing area of the country, and will exceed by a liberal margin the tillable land of all the states, excepting New York, on the Atlantic coast from Maine to Florida. Allowing 40 acres, the average size of irrigated farms, this area will make 1,250,000 farms, or a little less than one-fourth the number in the United States in 1900. The occupants of these farms will add directly to the population 6,250,000, and indirectly, in the accompanying mercantile, professional, manufacturing, and industrial classes, at least 3,125,000 more, a total increase in the population of the United States of 9,375,000, or nearly 12½ per cent.

The total value of all the farms in

1900, including all improvements except buildings, was \$13,115,000,000. At \$42.50 per acre, the average value of irrigated land, the 50,000,000 acres to be reclaimed will add to the value of farm land \$1,250,000,000. If buildings are included, the value will be increased \$775,000,000, while the augmented wealth through railroads, cities, mills, and factories is beyond estimation.

The annual value of all the farm products in 1900 was \$4,379,000,000. The average value per acre of products of irrigated lands was \$14.81. At this rate the area to be reclaimed will add products worth \$740,500,000, an addition of nearly one-sixth of the life-sustaining powers of the country.

The number of irrigating ditches and canals in operation in the United States exceeds 20,000, and their combined length is not less than 50,000 miles. If joined end to end they would reach twice around the world. Formed into one they would constitute a navigable canal, such as the Erie, thirty feet wide and five feet deep, extending from San Francisco to New York, a distance of over 3,000 miles.

The figures of the last census show that the works required to irrigate 7,263,273 acres cost \$64,289,601, an average of \$8.85 per acre. At this rate the expenditure required to reclaim the area proposed would be at least \$450,000,000. After the government has performed its part there will be no delay by the farmers in carrying on the work. While the initial expense is enormous, it is not comparable with the value of the crops which will be grown on the lands reclaimed. *The total cost of all the irrigation works in use in the country is only three-fourths of the value of the crops produced each year on irrigated lands.*



FORESTRY IN OHIO.

BY

WILLIAM R. LAZENBY,

PROFESSOR OF BOTANY, OHIO STATE UNIVERSITY.

TO every public-spirited citizen of Ohio the growing of forest trees and the preservation, improvement, and extension of existing woodlands are subjects of signal importance.

Not to speak of the effect upon the climate, the reckless destruction of our timber, with no effort to restore the supply, is compelling those who come after us to pay many times the cost at which we might and should have grown it.

But there can be no doubt that our improvidence in this respect is beginning to seriously affect the climate. While it has not been demonstrated that the removal of timber has essentially modified the average annual rainfall, and while it may not have changed to any marked extent the distribution of rain and snow throughout the year, we do know that certain serious changes have resulted.

In many sections of the state springs and wells are failing that never failed before. Streams and rivers are becoming more and more capricious in their flow, floods are more common, and drouths are more frequent, more severe, and more protracted. The winds are more destructive, frosts and hail are a more serious menace, while the washing or abrasion of slopes and hillsides, the banks of open ditches, streams, and rivers is doing almost irreparable injury. To make timber plentiful and to render the soil more productive, we must not only preserve and improve our existing woodlands, but replant many denuded areas. We should reclothe with valuable forest trees much of the rugged, broken land, all rocky crests, and steep hillsides—in short, every acre that is not utilized or is cultivated at a loss.

In a great agricultural state like Ohio at least 25 per cent of the total area

should be constantly clothed with forest trees. The best statistics at my command indicate that the proportion of woodland at the present time is less than 14 per cent, and the work of deforestation still goes on. We do not expect the individual land-owner to plant large areas of forests for the public good. That can be done only by the state or nation. The forest problem in Ohio, however, can be solved if each land-owner would plant some trees.

Forest trees can be profitably planted in nearly all sections of Ohio for at least three distinct and special purposes, namely: first, for timber; second, for shelter and protection; and, third, for ornament.

For the first purpose, all ravines and hillsides, every acre too rolling or too rocky for cultivation for ordinary crops, should be planted with the most appropriate and valuable varieties of timber trees. For the second purpose, protecting belts of trees should be planted wherever buildings, orchards, gardens, etc., are exposed to cold sweeping winds. The banks of rivers, streams, ponds, open ditches, levees, etc., may often be so planted with trees that they will be protected from abrasion by floods and rapid currents.

For ornamental purposes, public and private roads and driveways should be belted and embowered by stately graceful trees. Neither should our church and school yards, parks, cemeteries, and other public grounds be forgotten.

In order to improve our existing woodlands and make them more valuable for timber, we must keep up a constant succession of young growing trees of the best varieties. To do this it is necessary that no stock be allowed to graze in woodlots; greater precautions should be taken against fire, and all woodlots should be thinned and pruned. They

should be *cut out*, but never more *cut off*. Merchantable timber should be removed when most profitable, and worthless varieties, or tree weeds, should never be allowed to injure or retard the growth of better varieties.

For whatever purpose it may be planted, we should never forget that a *good tree* grows as thriftily as a *poor one*. It is wretched economy to preserve every tree—good, bad, or indifferent—that may happen to be growing upon our land; but until we see a fair proportion of our ground occupied it should be our aim to rear at least two better trees for every one we cut down.

Having briefly indicated what should be done, the important question yet remains, "How can it be best accomplished?"

Would not the following aid in bringing about the desired end:

1. The exemption from taxation of a certain percentage of woodland on each farm.
2. The appointment of a State Commissioner of Forestry to coöperate with and supplement the work of the Bureau of Forestry.
3. The establishment of a school of practical forestry in the State University.
4. The establishment of a State Arboretum, where every species and variety of our forest trees could be seen growing and their merits tested.
5. Large tracts of the cheaper lands of Ohio should be secured and managed by the state as reserves for permanent state forests.

NATIONAL BOARD OF TRADE.

REPORT OF STANDING COMMITTEE ON FORESTRY AND IRRIGATION AT ANNUAL MEETING HELD IN WASHINGTON, D. C., JANUARY 14.

SINCE the last meeting of the committee on irrigation of the National Board of Trade the efforts of the friends of irrigation have been crowned with a great success. After a hard fight Congress recognized national irrigation as a proper government function and enacted a law providing that the receipts from the sales of public lands in the western states and territories should be used for the construction of government irrigation works, the cost of the works to be prorated among the lands reclaimed and the amounts to be paid back to the government by the settlers and home-builders who take up the land and use the water.

The law is carefully drawn and will be the means of putting hundreds of thousands of actual settlers upon lands which are at the present waste and desert. It inaugurates the reclamation of the 100,000,000 acres distributed throughout the arid region which are capable of irrigation, and this will result in untold benefit to the nation. It is pregnant with vast possibilities. Irrig-

ated communities, as a rule, consist of small farms, constituting dense agricultural populations, the highest type of farming communities. Not only will the reclamation of this 100,000,000 acres of western lands enormously develop our internal trade and commerce and enlarge our home markets, but this broad development of the irrigation idea will tend to educate eastern farmers on irrigation methods. It is an established fact that irrigation will pay in every eastern state, and with the abundance of water supply and fine farming lands it only requires such a knowledge of the ease of irrigation methods and the profit in irrigation practices which the western farmers possess to induce the rapid subdivisions of thousands of farms and plantations in the East and South now relying entirely upon uncertain rainfall, into smaller farms using supplemental irrigation. Thus the rapid reclamation of the West will bring about an education in the East of great benefit.

This, however, is looking somewhat broadly into the future. At present,

the country is interested in the proper administration of the new irrigation law. The Interior Department, which has charge of the execution of the law, has expressed its intention of selecting such projects for the initial government works as present ideal conditions for dam construction and land reclamation which will make these works great object lessons to the country of the beneficent results of national irrigation. At the same time it appears that land speculators in the West have been showing great activity, and through fraudulent entries under the desert-land act and the commutation clause of the homestead act, are rapidly absorbing the best agricultural lands of that section. If this practice continues much longer, the valuable lands which the government proposes to reclaim will have passed into the private ownership of large corporations, which will result in their non-settlement by actual home-makers and their non-development. These acts should be repealed.

In his annual message to the present Congress, President Roosevelt gave expression to the growing demand that some check be put upon this rapid absorption of the public domain by interests which are opposed to the settlement of the west. He said:

"So far as they are available for agriculture and to whatever extent they may be reclaimed under the national irrigation law, the remaining public lands should be held rigidly for home-builders, the settler who lives on his land, and for none else. In their actual use, the desert-land law, the timber and stone law, and the commutation clause of the homestead law have been so perverted from the intention with which they were enacted as to permit the acquisition of large areas of the public domain for other than actual settlers, and the consequent prevention of settlement."

The effort to merge the national forest work into one Bureau under the Secretary of Agriculture failed last session. The consolidation should be effected by Congress, in accordance with the recommendations of the President, at the earliest possible opportunity.

Water for power and manufacturing purposes in every state in the Union, and for irrigation in the western states, is too intimately dependent upon rational forest preservation not to make the forest administration of the government one of the most vital internal questions.

(Signed)

W. H. CHADWICK,
Chicago;
FRANCIS B. THURBER,
New York;
GEORGE F. STONE,
Chicago;
F. L. HITCHCOCK,
Scranton;
O. L. WHITELAW,
St. Louis;
GEORGE H. ANDERSON,
Pittsburg;
(The Committee.)

The following resolutions were unanimously adopted by the National Board of Trade:

Resolved, That the reclamation of the arid lands of the United States and the maintenance of irrigated communities already created demand the preservation of forests as sources of water supply.

Resolved, That we commend the recommendations of President Roosevelt in his messages to Congress on the subject of forestry and irrigation, and urge the early enactment of a law which will fully carry into effect his recommendations as to forestry, and bring together the various branches of the forest work of the national government under the Bureau of Forestry of the Department of Agriculture, with appropriations adequate to enable the national government, in coöperation with the states, to effectively safeguard our forests from destruction.

Resolved, That we congratulate the country on the passage of the national irrigation act, and express our profound appreciation of the aid and coöperation of President Roosevelt and all friends of that measure in the Senate and House of Representatives in securing the passage of that act. We believe this action by Congress is marked by the conception

of one of the greatest projects ever undertaken by any government, and it inaugurates a new era in the progress of this nation and in the development of its internal trade and commerce and the enlargement of the home market for all our manufactures;

That the irrigable arid lands, which are estimated to comprise an area of over 100,000,000 acres, can and should be reclaimed just as rapidly as settlers will take them and repay the govern-

ment the cost of the irrigation works built for their reclamation;

That we especially commend that feature of the act which reserves the reclaimed land for actual settlers and home-makers only, and urge that in the future administration of the public domain this policy should be extended to include all public lands. To this end it is.

Resolved, That the Desert Land Act and Commutation Clause of the Homestead Act should be immediately repealed.

THE FORESTS OF RHODE ISLAND.

FROM THE REPORT OF THE RHODE ISLAND
AGRICULTURAL EXPERIMENT STATION, PRE-
PARED BY FRED W. CARD, HORTICULTURIST.

THE woodland of the state of Rhode Island has an area of approximately 400 square miles, or 40 per cent of the area of the state. A large part of the growth possesses no real value for timber purposes and much additional waste land has no tree growth whatever, but might be profitably planted and managed. The state has little to expect from forests in the way of influence on climate and water-flow. There are no mountains and few high hills; danger from floods is slight, and close proximity to the ocean insures a humid atmosphere. So the forest question in Rhode Island resolves itself into a purely economic one; that is, "Will it pay in dollars and cents to foster the forests?"

Along the coast, and indeed for some miles inland, very little real forest appears, and while the trees attain greater size in proportion to their distance from the shore, the actual forest growth is found only toward the western borders. White Pine and White Oak are the more predominant and valuable trees of the state, but many others will grow there readily and with profit to the grower—Red Oak, Chestnut, Hardy Catalpa, Red Pine, and Locust being recommended for planting.

The Rhode Island Agricultural Experiment Station looks upon the question of forestry in that state as one which has the sawmill as the end in view and the harboring of the resources of the state in reference to this end. It is held by those in charge of the station that the forests of the state possess sufficient economic value to warrant careful management and full development. It is unfortunate that there is no state Bureau of Forestry to make a careful and elaborate study of the problems involved, as the experiment station, with its many other duties, confessedly can do little more than suggest the possibilities.

Census statistics show that in 1900 there were \$233,597 invested in the lumber industry of Rhode Island, there being thirty-three sawmills and two tie and timber camps. Practically all of the timber reported as cut in the state is brought from other states. The lumber product of the state amounted in 1900 to 18,265,000 feet, b. m., of which approximately one-half was White Pine, with Chestnut and Oak furnishing nearly one-fifth. In addition to the lumber product, 2,567,000 shingles were manufactured and miscellaneous products to the value of \$6,883.

FORESTRY AND IRRIGATION IN CONGRESS

CALENDAR OF BILLS, RESOLUTIONS, AND OTHER
MEASURES RELATING TO FORESTRY, IRRIGA-
TION, AND THE DISPOSAL OF THE PUBLIC LANDS.

A RECAPITULATION of the work of Congress relative to forestry and irrigation from the opening of the session until the Christmas recess was given in the January issue of **FORESTRY AND IRRIGATION**. The following record gives the summary of Congressional acts from January 5, the first meeting after the holidays, up to and including January 31:

During January there were no less than 65 petitions presented in the Senate and House of Representatives asking for the repeal of the desert land law and the commutation clause of the homestead act, every one of them coming from a trade or labor union affiliated with the great labor federations of the country. Opposed to these and to the repeal of the acts in question there were seven petitions from citizens and business men's associations. All of the latter were in the states of Idaho and Minnesota, while the pro-repeal petitions came from states scattered throughout the country, with a majority from the North Atlantic and Middle Western states.

January 6.

Senator Gibson, from the Committee on the Public Lands, to whom was referred the bill (S. 6339) to confirm certain forest lieu selections made under the act approved June 4, 1897 (30 Stats., 36), reported it without amendment and submitted a report thereon.

Mr. Bartlett presented a resolution of the legislature of Georgia upon the subject of irrigation and drainage for that state. Referred to the Committee on Agriculture.

Mr. Thayer presented the resolution of Colonel Timothy Bigelow Chapter, D. A. R., Worcester, Mass., indorsing the Appalachian Forest Reserve Bill. Referred to the Committee on the Public Lands.

The bill (S. 1969) to conserve the flood waters of Lake Tahoe, in the States

of California and Nevada, and to regulate the flow thereof, was disposed of in the same manner.

January 12.

Senator Perkins presented petitions of the San Antonio Fruit Exchange, of Pomona; of the Charter Oak Citrus Association, of Charter Oak, and of the Placentia Orange Growers' Association, of Fullerton, all in the State of California, praying for the enactment of legislation to protect the forest reserves of southern California. Referred to the Committee on Forest Reservations and the Preservation of Game.

Senator Nelson introduced a bill (S. 6871) to grant to the State of Minnesota certain vacant lands in said state for forestry purposes. Referred to the Committee on the Public Lands.

A message from the President of the United States, read in the Senate, announced that he had approved and signed, on January 9, an act (S. 6138) to set apart certain lands in the State of South Dakota as a national park, to be known as the Wind Cave National Park.

Mr. Mondell introduced a bill (H. R. 16603) to authorize and regulate the sale and use of timber on the unappropriated and unreserved public lands, and to prevent depredations thereon. Referred to the Committee on the Public Lands.

Senator Nelson, from the Committee on the Public Lands, to whom was referred the bill (S. 6730) to regulate the use of forest reserve timber, asked to be discharged from its further consideration, and that it be referred to the Committee on Forest Reservations and the Protection of Game; which was agreed to.

Senator Dietrich introduced a bill (S. 6886) to authorize the leasing of grazing lands in the State of Nebraska. Referred to the Committee on the Public Lands.

A message from the President of the United States to the House of Representatives announced that he had signed the acts (H. R. 15605 and 15606) authorizing the construction of dams and locks for rice irrigation in Louisiana on January 10, 1903, these acts becoming law on that day.

Mr. Moody, of Oregon, reported from the Committee on the Public Lands the bill (H. R. 15008) providing for the better separation and utilization of public and private lands within the limits of railroad land grants in the arid region, reported the same with amendment, accompanied by a report (No. 3101); which said bill and report were referred to the Committee of the Whole House on the state of the Union.

Mr. Heatwole introduced a petition of the citizens of Faribault, Minn., requesting the removal of the tariff duties on wood, lumber, and coal. Referred to the Committee on Ways and Means.

January 14.

In the speech of Senator Nelson, of Minnesota, on the Statehood bill there was much of interest in relation to irrigation and forestry in the territories of New Mexico and Arizona. It was presented in the form of affidavits, depositions, and excerpts from reports and correspondence. From time to time during the statehood discussion the question of irrigation in the proposed states has played an important part, but has been too voluminous, confusing, and in many cases contradictory, to be inserted in this record.

Senator Burton introduced a bill (S. 6968) granting the Central Arizona Railway Company a right of way for railroad purposes through the San Francisco Mountains Forest Reserve in the Territory of Arizona. Referred to the Committee on the Public Lands.

January 15.

The bill (H. R. 16066) to amend an act entitled "An act to provide for the use of timber and stone for domestic and industrial purposes in the Indian Territory," approved June 6, 1900, was presented to the President of the United States for his approval.

Mr. Shackelford introduced a bill (H. R. 16757) for the purchase of a national forest reserve along the Big Niangua, in Missouri, to be known as the National Forest Reserve. Referred to the Committee on Agriculture.

Mr. Lacey introduced a bill (H. R. 16760) granting the Central Arizona Railway Company the right of way for railroad purposes through the San Francisco Mountains Forest Reserve, in the Territory of Arizona. Referred to the Committee on the Public Lands.

Mr. Brownlow introduced a resolution (H. R. 391) for the consideration of the bill to establish the national Appalachian forest reserve. Referred to the Committee on Rules.

January 19.

Senator Gibson, from the Committee on the Public Lands, to whom was referred the bill (S. 5279) authorizing the Secretary of the Interior to restore to public entry lands embraced in whole or in part within segregations for reservoirs, reported it without amendment and submitted a report thereon.

Senator Burton, from the Committee on Pacific Islands and Porto Rico, to whom was referred the bill (H. R. 11997) granting to the Hawaii Ditch Company, Limited, the right of way over public lands in the districts of North and South Kohala, in the Island of Hawaii, for the purpose of constructing and maintaining ditches or canals and the necessary dams, reservoirs, and the like for irrigation purposes in said districts, reported it with an amendment and submitted a report thereon.

Senator Mitchell submitted an amendment proposing to appropriate \$15,000, to be divided equally between the Department of Agriculture and the Department of the Interior, to enable the Secretary of Agriculture to examine into all matters concerning agriculture, forestry, and public roads of the territory of Hawaii, and to enable the Secretary of the Interior to examine the laws of Hawaii relating to its public lands, intended to be proposed by him to the sundry civil appropriation bill. Referred to the Committee on the Pacific Islands and Porto Rico and ordered to be printed.

Senator Millard presented petitions of sundry citizens of Bingham, Alliance, Keano, Mullen, Hecla, Pullman, Chadron, Whitman, Lena, Lakeside, Orlando, Hyannis, Bridgeport, Hemingford, Antioch, Rushville, Luella, Dalton, Keystone, Lilac, Tryon, Thedford, Seneca, and Irwin, all in the State of Nebraska, praying for the enactment of legislation providing for the leasing of vacant public domain suitable for grazing in the State of Nebraska. Referred to the Committee on the Public Lands.

Mr. Mann presented resolutions of the Illinois Lumber Dealers' Association, Chicago, Ill.; National Hardwood Lumber Association and the National Lumber Manufacturers' Association, St. Louis, Mo., favoring the establishment of a national forest reserve in the Southern Appalachians. Referred to the Committee on the Public Lands.

January 20.

Senator Bard, from the Committee on the Public Lands, to whom it was referred, reported the bill (S. 1270) granting to the State of California 5 per cent of the net proceeds of the cash sales of public lands in said state, without amendment, and submitted a report thereon.

Mr. Neville introduced resolutions from the Western Stock Growers' Association and Thomas County (Nebraska) Stock Growers' Association relative to the land-leasing bill. Referred to the Committee on the Public Lands.

January 24.

Senator Burton, from the Committee on Forest Reservations and the Protection of Game, to whom was referred the bill (S. 6689) for the protection of wild animals, birds, and fish in the forest reserves of the United States, reported it without amendment and submitted a report thereon.

He also submitted a report from the same committee, accompanied by a bill (S. 7123) for the protection of the public forest reserves and national parks of the United States, which was read twice by its title.

On motion of Mr. Wadsworth, the House of Representatives resolved itself into the Committee of the Whole House for the consideration of the agricultural

appropriation bill. The appropriation on irrigation was cut down from \$65,000 to \$25,000. The report reads: "That upon full and careful consideration, your committee have reached the conclusion that the appropriation heretofore made for this specific purpose might be reduced without detriment to the public interests, and has therefore recommended the sum of \$25,000 for the ensuing year."

January 28.

Mr. Shafroth, from the Committee on the Public Lands, to which was referred the bill (H. R. 16731) permitting the town of Montrose, Colo., to enter 160 acres of land for reservoir and water purposes, reported the same with amendments, accompanied by a report (No. 3404). Bill and report referred to the Committee of the Whole House on the state of the Union.

Mr. Burleson introduced a concurrent resolution (H. C. Res. 76) directing information from the Secretary of the Interior concerning public lands in New Mexico, Wyoming, and Nebraska. Referred to the Committee on the Public Lands.

Also a resolution (H. Res. 415) requesting information from the Secretary of the Interior concerning public lands in New Mexico, Wyoming, and Nebraska. Referred to the Committee on the Public Lands.

Mr. Neville presented a memorial for an investigation by the irrigation investigation division of the Department of Agriculture for the benefit of those using water from the Platte River in the three states through which it flows. Referred to the Committee on Agriculture.

January 29.

Senator Gallinger offered the following resolution, which was referred to the Committee on Printing: *Resolved*, That 5,000 copies of the Woodsman's Handbook, Part 1, being Bulletin 36, Bureau of Forestry, United States Department of Agriculture, be printed and bound at the Government Printing Office for the use of the Senate. He further stated, for the information of the chairman of the Committee on

Printing, "That this is one of the few practical books that Senators may have for distribution among their constituents. The Department of Agriculture printed an edition which is entirely exhausted, and I have a very considerable number of applications now on file for it. I hope the Committee will give the resolution immediate attention."

January 30.

Senator Clay introduced an amendment to the agricultural appropriation bill proposing to appropriate \$5,000 to enable the Department of Agriculture to study the character and extent of adulterations of the oil of turpentine and other products of the pine forests, intended to be proposed by him. It was ordered to be printed with the accompanying papers, and referred to the Committee on Agriculture and Forestry.

A message from the Senate announced to the House of Representatives that it had passed an act (S. 6867) to authorize the building of dams and other improvements in the Columbia River, in the State of Washington, in which the concurrence of the House was requested. The bill was referred to the House Committee on Interstate and Foreign Commerce.

January 31.

Senator Mason introduced a bill (S. 7314) granting land warrants to soldiers and sailors of the Spanish-American War. Referred to the Committee on the Public Lands.

A bill (S. 6754) authorizing the town of Batesville, Ark., to draw water from the pool of dam No. 1, Upper White River, was passed by the Senate without amendment.

RECENT PUBLICATIONS.

Irrigation Institutions. By ELWOOD MEAD, Chief of Division of Irrigation Investigations, United States Department of Agriculture. Pp. 383. Illustrated. \$1.25 net. Macmillan & Co., New York.

This is the latest addition to the Citizen's Library of Economics, Politics, and Sociology. The author was for a number of years State Engineer of Wyoming and has made this subject a study for many years.

The book is a well written and clear exposition of the growth and present condition of the arid region, so far at least as the public land laws and the irrigation laws of the region are concerned; but unlike most books on the West, its dominant tone is pessimistic.

There are a few inaccuracies of statement, none of them of serious importance except the objection stated on page 26 to the Carey Act, passed by Congress and approved August 18, 1894, that—

"It requires them [the states] to assume the responsibility and expense in disposing of the land, to run all risks of financial loss in the building of canals, and to be at all times subject to the scrutiny of the Interior Department, yet in the final outcome, if there is any profit in the enterprise, it must be paid into the national treasury."

The language of the law upon this point is as follows:

"Any surplus of money derived by any state from the sale of said lands in excess of the cost of their reclamation shall be held as a trust fund for and be applied to the reclamation of other desert lands in said state."

Thus providing that the surplus shall be used for the benefit of the state.

The author is a strong advocate of the system of state irrigation regulation by means of a state engineer and a board of control, consisting of persons who have made a practical study of irrigation. His arguments seem to imply that other forms of regulation, more particularly those requiring adjudication of claims to the use of water by the courts, must lead to the perpetuation and extension of existing annoyances. In his advocacy of the former system, the writer has exaggerated somewhat his points of criticism of the latter, as, for instance, where he says, on page vi of his preface, that "irrigation laws are so ambiguous or contradictory that the finite intellect is not able to interpret their meaning."

The author takes strong ground in favor of some of the modifications of the public land laws now being vigorously pushed, favoring the repeal of the Desert Land Act (page 21); he approves reducing the size of the homestead on irrigated land (page 38), and shows the necessity of a proper law for the leasing of grazing lands, calling attention particularly to the need of a classification of these lands by the general government (pages 39 and 380).

His statement of the essentials of a proper law concerning grazing lands deserves to be quoted:

"The grazing lands should be leased, not sold, because the limit of irrigation has not been fixed, nor are the possibilities of these lands sufficiently known for the limits of the homestead to be marked out. Care should be

taken that these leases do not interfere with actual settlement. This can be done by having the lands classified by the general government, and the grazing and irrigable areas segregated, or by having every lease subject to entry by the actual cultivators under the Homestead Law" (page 39).

In the thirteenth chapter the author presents a clear analysis of the questions relating to riparian rights to water and to the conflict arising between the states as to the use of the water of streams flowing from one to another.

All readers may not agree with Mr. Mead's views; nevertheless he has made a valuable contribution to the literature of the subject.

Economics of Forestry. By Dr. B. E. FERNOW, Director of the New York State College of Forestry. Pp. 520. Price, \$1.50 net. Published by Thomas Y. Crowell & Co., New York.

The latest volume to be added to Crowell & Co.'s Library of Economics and Politics is by Dr. B. E. Fernow, and is entitled the "Economics of Forestry." Dr. Fernow's book follows Mr. Newell's excellent work on "Irrigation in the United States." Volumes on forestry and irrigation undoubtedly belong in such a collection of books, as both the forest and water problems are among the most important economic questions affecting this country at the present time.

The author of this volume states in his preface that it is a reference book for students of political economy and professional and lay students of forestry. We believe it will be found not only of great value to such persons, but also that the general reader will see much of interest in it.

Dr. Fernow has long been a student of forest problems both in the United States and in Europe, and this book is the result of many years of observation. While much of the matter contained in the book will not be new to professional foresters, yet its repetition cannot be otherwise than helpful. The volume contains an immense amount of valuable information, and a wide reading of it will undoubtedly stimulate interest in forestry throughout the country.

The titles of the twelve chapters will give an idea of the scope of the work: "The Relation of the State to Natural Resources," "The Forest as a Resource," "The Forest as a Condition," "Forest and Forestry Defined," "Factors of Forest Production and Business Aspects," "Natural History of the Forest," "Methods of Forest Crop Production," "Silviculture," "Methods of Business Conduct," "Forest Economy," "Principles and Methods of Forest Policy," "Forest Policies of Foreign Nations," "Forest Conditions of the United States," "The Forestry Movement in the United States." There is also an appendix of valuable notes and tables.

Among Green Trees. By JULIA ELLEN ROGERS. 8vo, pp. 220. Illustrated. Published by A. W. Mumford, Chicago. Price, \$3.00.

There has long been a demand for a nature-

study book on trees that would contain something more than mere systematic studies. This demand Julia Ellen Rogers has met in an admirable manner in her book entitled "Among Green Trees." This work is divided into four parts. In the first part (pp. 1-42), under the heading "Outdoor Studies with Trees," the author writes in a very entertaining way on life-history of the Maple, how to tell the age of a tree, the battle among the twigs, thorns, and prickles, and other subjects. The second part (pp. 43-65) deals with the physiology of trees. A third section of the book (pp. 65-119) treats of the cultivation of trees. In a very clear and fascinating way the principles of landscape gardening are discussed, and one is told how to plant and trim trees. The question of forestry, the farmer's woodlot, fruit trees, nursery trees, and diseases of trees—all subjects seldom mentioned in nature-study work—add materially to the value of the volume. In the fourth part about 125 different kinds of trees are described. Too much cannot be said in praise of the workmanship of the book. The twenty-five full-page photographs of entire trees and many half-tones of trunks and leaves are identical with those formerly issued by the publishers in the portfolio known as series I, II, and III of "Typical Forest Trees." It is to be regretted that these splendid illustrations of what are termed "forest trees" are from photographs of trees grown in the open, and thus containing many characteristics which do not belong to forest trees.

Forestry Quarterly. Published under the direction of the New York State College of Forestry. Pp. 40. Single copies, 25c.; \$1.00 a year. Ithaca, N. Y.

The second number of the *Forestry Quarterly* contains as its leading feature the address delivered before Section I, American Association for the Advancement of Science, at Washington, D. C., on "The Outlook of the Timber Supply in the United States," by Dr. B. E. Fernow. This address will be found among the pages of the present issue of FORESTRY AND IRRIGATION. The remainder of the space of the *Quarterly*, except that taken up by short reviews, is devoted to two technical articles, "Natural Reproduction in the Adirondack Forests," by A. Knechtel, and a paper "On the Form of the Bole of the Balsam Fir," by Judson F. Clark, the latter being illustrated with a diagram. The scope of the publication is confined to technical papers, but those on the timber supply and natural reproduction in the Adirondacks will appeal to the general reader.

Camp Fires in the Wilderness. By E. W. BURT. Pp. 164. Illustrated. National Sportsman Press, Boston, Mass.

This neat little volume is meant as a sort of guide to campers and hunters. The first half of the book is devoted to listing the articles that should be taken along on a hunting and fishing trip. There is a lot of useful information for those not well acquainted with the necessities in the way of clothing and cooking

utensils to be taken along on an outing in the woods. The experienced hunter will also find many good reminders in the book.

Following the chapters on camp equipment the author gives a number of sketches of hunting and fishing trips in the Maine woods. The volume is appropriately illustrated with half-tones from photographs, and is neatly printed and bound.

PUBLISHER'S NOTES.

The charms of the boys' school have been written by many authors. "Tom Brown's School Days" made its writer famous, and Kipling's "Stalky & Co." will amply bear its share of Kipling's fame. Had the latter attended a school like the Agassiz Hall School of Alta, California, he might readily have gained the material for "Jungle Book" stories while yet in a preparatory academy; for this school good students. The latest trip, forming the takes annual outings in its endeavor to develop healthy, wide-awake men as well as third annual excursion, took master and pupils on an expedition for big game into the wilds of Mexico. Last year they sailed 300 miles through the canyons of the Colorado. This year the table-lands of Sonora, Mexico, with their grizzlies, black bear, panther, wolf, beaver, deer, antelope, mountain sheep, wild turkey, and quail, formed the objective point. Not only did the trip afford, in its adventurous aspects, a good lesson in self-reliance and courage, but it gave excellent opportunities for close and interesting nature-study and collecting.

Mr. Price, the head master of the school, is a graduate of Stanford University, is well known as a keen naturalist and an indefatigable collector. The publisher of this magazine, from a personal knowledge of him, his methods, and his corps of teachers, can say that Agassiz Hall School ought to be the ideal place for good, live, healthy, boyish boys.

The Gage County Nurseries, Beatrice, Nebraska, while doing a general nursery business, make a specialty of forest tree seedlings, and being situated as they are in the northwest, are especially fitted for furnishing the material needed for forestation in that section. Their business is not, however, restricted to that part of the country, as they fill large orders each season from California, New York, and Oregon. They grow and supply only the most satisfactory kinds and do not handle sorts which are defective nor will they ask their customers to do so. Their general catalogue can be had for the asking.

LAUGHLIN FOUNTAIN PEN

The Best at Any Price

Sent on approval to responsible people.

A Pocket Companion of never ending usefulness, a source of constant pleasure and comfort.

To test the merits of Forestry and Irrigation as an advertising medium we offer your choice of these popular styles superior to the

\$3.00

grades of other makes for only

\$1.00

Unconditionally Guaranteed
Pre-eminently Satisfactory.

Try it a week, if not suited, we buy it back, and give you \$1.10 for it (the additional ten cents is to pay for your trouble in returning the pen). We are willing to take chances on you wanting to sell; we know pen values—you will when you have one of these.

Finest quality hard Para rubber reservoir holder, 14k. Diamond Point Gold Pen, any desired flexibility in fine, medium or stub, and the only perfect ink feed known to the science of fountain pen making.

Sent postpaid on receipt of \$1.00 (Registration, 8c extra.)

This great Special Offer is good for just 30 days. One of our Safety Pocket Pen Holders free of charge with each pen.

Remember—There is No "just as good" as the Laughlin; insist on it; take no chances.

State whether Ladies' or Gentlemen's style is desired. Illustrations are full size of complete article. Address

LAUGHLIN MFG. Co.,
841 Griswold St.,
Detroit, Mich.

FORESTRY

We make a specialty of growing seedlings for Forestry Purposes. A portion of our nursery is utilized for nothing else. Our seeds are always the best procurable and may be depended upon as being inferior to none.

AUTHENTIC SEEDS STURDY SEEDLINGS

Write for a copy of our pamphlet entitled "Trees for Timber Purposes." It gives hints how to raise from seed, how and where to plant them, the best kinds, etc. Also quotes prices on Seeds and seedlings.

QUALITY PARAMOUNT

THOMAS MEEHAN & SONS, Inc.

Nurserymen and Tree Seedsmen
DRESHERTOWN, MONT. COUNTY, ... PENNA.

ORCHIDS

We are the largest Orchid growers in the United States

Our illustrated and descriptive Catalogue of Orchids is now ready and may be had on application

Orchid Growers
and Importers...

LAGER & HURRELL
SUMMIT, N. J.

ORCHIDS

MILLIONS...

Of Forest Tree Seedlings grown each season. Also Apple and Pear Seedlings and a complete General Nursery Stock. Write for our Catalogue, Free.

Gage County Nurseries

Box No. 601

Beatrice, Neb.

Money Rolls to Agents

that sell nursery stock from the famous

GREELEY, COLORADO, NURSERIES

whose stock is better adapted to all localities than any others. Agents wanted in every county. Write at once for terms and territory, giving reference.

210 Kinds for 16c.

It is a fact that Salzer's seeds are found in more gardens and on more farms than any other in America. There is reason for this. We own and operate over 3000 acres for the production of our choice seeds. In order to induce you to try them we make the following unprecedented offer:

For 16 Cents Postpaid

25 sorts wonderful onions,
25 sorts elegant cabbage,
15 sorts magnificent carrots,
25 peerless lettuce varieties,
25 rare luscious radish,
25 splendid beet sorts,
75 gloriously beautiful flower seeds,

in all 210 kinds positively furnishing bushels of charming flowers and lots and lots of choice vegetables, together with our great catalogue telling all about Macaroni Wheat, Billion Dollar Grass, Teosinte, Bromus, Speltz, etc., all for only 16c. in stamps and this notice.

Onion seed at but 60c. a pound.
JOHN A. SALZER SEED CO.,
La Crosse, Wis.

TIMBER LANDS

FOR SALE.

One tract of 23,000 acres, one tract of 10,000 acres, in Eastern Louisiana, and one tract of 3,500 acres in Eastern Texas.

JOHN T. JUDD,
LAKE PROVIDENCE, LA.

Nut Trees.

Grafted Pecans, Walnuts, Chestnuts and Seedling Nut Trees of all kinds.

Send four cents for our descriptive catalogue and price list.

THE AMERICAN PLANT & SEED CO.

NASHVILLE, TENN.

The Publishers of

FORESTRY AND IRRIGATION

will pay 25 cents each for all copies of the following:

The Forester, July, 1901

" " December, 1901

Forestry and Irrigation, February, 1902


" " March, 1902

Copies must be sent in good condition to

FORESTRY AND IRRIGATION

Atlantic Building, Washington, D. C.

In writing advertisers kindly mention FORESTRY AND IRRIGATION



An Extract From Her Letter

"If you could only be here this winter morning and see for yourself, you would no longer doubt me. Roses are blooming in our front yard, and all nature is as far advanced in this lovely American summerland as it will be in your cold Eastern home by June.

"We made the trip from Omaha to California via the Union Pacific to avoid the detour routes, riding on the great California train which surpasses any train traversing the American continent—'The Overland Limited.'

"As less time is consumed on the Union Pacific in reaching your destination, there are fewer incidental expenses en route.

"If you want to reach California without suffering any of the inconveniences of winter travel, be sure that your ticket reads over the Union Pacific."

The UNION PACIFIC is the only line running through trains to
 • California from Omaha; its fast trains reach their destination
 sixteen hours ahead of all competitors.

Full information cheerfully furnished on application to
E. L. LOMAX, Omaha, Neb.,
General Passenger and Ticket Agent.

College Posters.

Artistic and life-like; size 14x22 inches; printed in colors of the Universities represented. Following is a list of those now ready (others in preparation): . . .

YALE, HARVARD,
 PRINCETON, PENNSYLVANIA,
 CORNELL, ANNAPOLIS,
 WEST POINT,
 BROWN, and POSTER GIRL.

Price 25 Cents each or Five for \$1.00. Ask your newsdealer or stationer for them or send to

THE POTOMAC PRESS, Publishers,
 94 Atlantic Building, Washington, D. C.

The Potomac Press wants a live representative in schools and colleges for these goods, and offers an excellent opportunity to college book stores and self-supporting students.

R.I.P.A.N.S

R.I.P.A.N.S Tabules
Doctors find
A good prescription
For mankind.

The 5-cent packet is enough for an ordinary occasion. The family bottle (price 80 cents) contains a supply for a year.

Five Great Irrigated Valleys

ARKANSAS VALLEY, COLORADO. Altitude 3,400 to 4,600 ft.; beet-sugar factories, thousands of acres of alfalfa, millions of cantaloupes, extensive orchards, flocks of sheep; largest irrigated section in the U. S. Extensive cattle feeding and dairy interests. Population doubled in five years.

PECOS VALLEY, NEW MEXICO. Altitude 3,000 to 4,000 ft.; 175 miles long; on edge of Great Plains cattle pastures, affording profitable home market for alfalfa and grain; noted for its large orchards and fine quality of vegetables; artesian belt with 300 flowing wells.

RIO GRANDE VALLEY, NEW MEXICO. Altitude 3,700 to 5,300 ft.; 350 miles long; great sheep-raising section; mining in adjacent mountains; adapted to fruit raising and small farms.

SALT RIVER VALLEY, ARIZONA. Altitude 1,000 ft.; 60 miles long and 20 miles wide; special industries—early oranges, live stock, vegetables, small fruit, alfalfa, bee culture.

SAN JOAQUIN VALLEY, CALIFORNIA. Altitude 50 to 400 ft.; 20 miles long, 50 miles wide; wheat raising, live stock, oil wells, alfalfa, raisin and wine grapes, olives, figs, citrus and deciduous fruits, almonds, walnuts, lumbering and mines in mountains.

ALL FIVE VALLEYS have never-failing water supply, extensive systems of irrigating ditches, and rich soil, insuring profitable crops. Pleasant climate, especially in winter. Thriving towns, affording good markets. Directly reached by the SANTA FE.

For information about farm lands, manufactures, and general business openings, address

G. C. DILLARD, G. E. P. Agt., 377 Broadway, N. Y., or Industrial Commissioner

A. T. & S. F. Ry. System,
Great Northern Bldg., Chicago

Santa Fe

FARMING in COLORADO, UTAH ... and NEW MEXICO ...

The farmer who contemplates changing his location should look well into the subject of irrigation. Before making a trip of investigation there is no better way to secure advance information than by writing to those most interested in the settlement of unoccupied lands. Several publications, giving valuable information in regard to the agricultural, horticultural, and live stock interests of this great western section have been prepared by the **Denver & Rio Grande and the Rio Grande Western**, which should be in the hands of all who desire to become acquainted with the merits of the various localities. Write

S. K. HOOPER, G. P. & T. A.
... DENVER, COLORADO ...



To the West

The North-Western Line is the only double track railway from Chicago to the Missouri River.

The double track is now completed between Chicago and Council Bluffs. Four fast trains each way daily between Chicago and Omaha, three trains daily to the Pacific Coast and two to Denver.

A double track railway across the western prairies means a great deal of history-making, empire-building, American energy.

The story of the western country and of the Pioneer Line that has played so great a part in its progress is interestingly told in a booklet which will be sent on receipt of a two-cent stamp to pay postage.

W. B. KNISKERN, PASS'G TRAFFIC MANAGER,
CHICAGO.



Scene in Eagle River Canyon along Denver & Rio Grande R. R.

In writing advertisers kindly mention FORESTRY AND IRRIGATION.

ORGANIZED APRIL, 1882.

INCORPORATED JANUARY, 1897.

THE American Forestry Association

OFFICERS FOR 1903.

President.

Hon. JAMES WILSON, Secretary of Agriculture.

First Vice-President.

Dr. B. E. FERNOW, Ithaca, N. Y.

Corresponding Secretary.

F. H. NEWELL, Washington, D. C.

Recording Secretary, GEORGE P. WHITTLESEY, Washington, D. C.

Treasurer, OTTO LUEBKERT, Washington, D. C.

Directors.

JAMES WILSON.

HENRY S. GRAVES.

EDWARD A. BOWERS.

FREDERICK V. COVILLE.

B. E. FERNOW.

HENRY GANNETT.

OTTO LUEBKERT.

F. H. NEWELL.

FILIBERT ROTH.

GIFFORD PINCHOT.

GEORGE P. WHITTLESEY.

Vice-Presidents.

SIR H. G. JOLY DE LOTBINIÈRE, Victoria, B. C.
CHARLES C. GEORGESEN, Sitka, Alaska.
D. M. RIORDAN, Flagstaff, Ariz.
THOMAS MCRAE, Prescott, Ark.
WM. R. DUDLEY, Stanford University, Cal.
HENRY MICHELSEN, Denver, Col.
ARTHUR T. HADLEY, New Haven, Conn.
WM. M. CANBY, Wilmington, Del.
A. V. CLUBBS, Pensacola, Fla.
R. E. REPPARD, Savannah, Ga.
CHAS. DEERING, Chicago, Ill.
JAMES TROOP, Lafayette, Ind.
THOMAS H. MACBRIDE, Iowa City, Iowa.
L. W. YAGGY, Hutchinson, Kansas.
S. C. MASON, Berea, Ky.
LEWIS JOHNSON, New Orleans, La.
EDWARD L. MELLUS, Baltimore, Md.
JOHN E. HOBBS, North Berwick, Me.
N. S. SHALER, Cambridge, Mass.
CHARLES W. GARFIELD, Lansing, Mich.
SAMUEL B. GREEN, St. Anthony Park, Minn.
WILLIAM TRELEASE, St. Louis, Mo.
CHARLES E. BESSEY, Lincoln, Neb.
JOHN GIFFORD, Princeton, N. J.

EDWARD F. HOBART, Santa Fe, N. M.
W. A. WADSWORTH, Geneseo, N. Y.
C. A. SCHENCK, Biltmore, N. C.
FRANK WHITE, Bismarck, N. D.
WM. R. LAZENBY, Columbus, Ohio.
A. C. SCOTT, Stillwater, Okla.
J. T. ROTHROCK, West Chester, Pa.
H. G. RUSSELL, E. Greenwich, R. I.
N. E. HANSEN, Brookings, S. D.
THOMAS T. WRIGHT, Nashville, Tenn.
WM. L. BRAY, Austin, Texas.
E. F. HOLMES, Ogden, Utah.
FRANK W. ROLLINS, Concord, N. H.
REDFIELD PROCTOR, Proctor, Vt.
D. O. NOURSE, Blacksburg, Va.
ADDISON G. FOSTER, Tacoma, Wash.
A. D. HOPKINS, Morgantown, W. Va.
THOMAS F. WALSH, Washington, D. C.
JOS. M. CAREY, Cheyenne, Wyo.
ELIHU STEWART, Ottawa, Ont.
WM. LITTLE, Montreal, Quebec.
GEO. P. AHERN, Manila, P. I.
WM. R. CASTLE, Hawaii.
J. H. MCLEARY, San Juan, P. R.

Annual Dues, \$2.00. Life Membership, with exemption from further dues, \$100.00.

Sustaining Membership, \$25.00 a year.

FORESTRY AND IRRIGATION is the official organ of the Association, and is sent regularly to all members.

APPLICATION FOR MEMBERSHIP.

To the Assistant Secretary,

AMERICAN FORESTRY ASSOCIATION,

WASHINGTON, D. C.

DEAR SIR: I hereby signify my desire to become a member of the American Forestry Association. Two dollars (\$2.00) for annual dues enclosed herewith.

Very truly yours,

Name.....

P. O. Address.....



AND

Iron Mountain Route

KNOWN AS THE

Great Southwest System

Connecting the Commercial Centers and Rich Farms of

The Broad Wheat and Corn Fields and Thriving Towns of

The Fertile River Valleys and Trade Centers of

The Grand, Picturesque and Enchanting Scenery and the Famous Mining District of

The Agricultural, Fruit, Mineral and Timber Lands and Famous Hot Springs of . .

The Beautiful Rolling Prairies and Woodlands of the

* * *

The Sugar Plantations of

The Cotton and Grain Fields, the Cattle Ranges and Winter Resorts of

Historical and Scenic

* * *

And forms, with its connections, the Popular Winter Route to

* * *

**MISSOURI,
KANSAS,
NEBRASKA,
COLORADO,
ARKANSAS,
INDIAN
TERRITORY,
LOUISIANA,
TEXAS,
OLD AND
NEW MEXICO
ARIZONA and
CALIFORNIA.**

FOR DESCRIPTIVE AND ILLUSTRATED PAMPHLETS, LAND FOLDERS, ETC., ADDRESS COMPANIES' AGENTS.

C. G. WARNER,
Second Vice-President,

RUSSELL HADDING,
Third Vice-Pres't and Gen'l Mgr.,
ST. LOUIS, MO.

H. C. TOWNSEND,
Gen'l Pass'r and Ticket Agent,

NEW YORK OFFICE, 335 BROADWAY.



THORBURN'S SEEDS

They have been developed by careful, thoughtful propagation throughout the Nineteenth century. Thorburn's 116-page Century Catalogue of these

Seeds of a Century

is the 100th successive annual issue. If you would have a more beautiful lawn, or a more productive garden, send for it. It's free.

J. M. THORBURN & CO.
(late of 15 John Street)
86 Cerilandt Street, New York.

New York State College of Forestry

Cornell University
Ithaca, New York

Offers a complete four-year course in Forestry leading to the degree of Forest Engineer (F. E.).

Special students for shorter terms accepted if properly prepared.

Tuition, \$100 per year. New York State students free.

The spring terms of the junior and senior years are spent in the Demonstration Forests in the Adirondacks, devoted to practical work.

Requirements for admission similar to those in other branches of the University. Send for prospectus.

Instruction in preparatory and collateral branches given by the Faculty of the University.

For further information, address Director of State College of Forestry, Ithaca, N. Y.

B. E. FERNOW, LL. D., *Director*

JOHN GIFFORD, D. Oec., *Assistant Professor*

JUDSON F. CLARK, Ph.D., *Assistant Professor*

YALE FOREST SCHOOL

NEW HAVEN, . . CONNECTICUT

The course of study in THE YALE FOREST SCHOOL covers a period of two years. Graduates of collegiate institutions of high standing will be admitted without examination, provided they can show the requisite knowledge of Botany, Geology, and Inorganic Chemistry.

The Summer School of Forestry is conducted at Milford, Pike County, Penna. The session in 1903 will open July 1st and continue seven weeks

For further information address

Henry S. Graves, Director, New Haven, Conn.

